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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:
ELECTRO-PLATERS REVIEW.

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A MONTHLY JOURNAL RELATING TO THE METAL AND PLATING TRADES

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Vol. 15. NEW YORK, FEBRUARY, 1917. No. 2.

MECHANICAL PLATING

Nickel Plating by the Barrel Process.

Written for The Metal Industry by D. W. Robinson, Foreman Electro-plater.*

The demand for better plating and more uniform results with economy has been and is being met by various mechanical inventions for plating work, especially small parts in bulk. Of these inventions the plating barrel is no doubt most commonly and perhaps the most successfully used. Results but little short of wonderful have been, and are being produced daily and the end is not yet, for the ideal plating barrel outfit has not been built.

Much, however, has been done with the equipments now in use that was thought impossible but a few years ago. A vast amount of literature has been produced on the subject of plating. Nickel plating in particular has been a favorite subject and with full recognition of the truth of the saying that "there is nothing new under the sun," the writer is venturing to set before the readers of The Metal Industry something along the line of nickel plating by the barrel method, not presuming that anything in this contribution is final, but trusting that rather it may serve to add a little to the general knowledge.

D. W. ROBINSON.

Much effort and a great deal of experimentation has been carried on in the effort to get first class results economically. Results which seemed to be perfectly satisfactory when produced in an experimental way have proved to be most unsatisfactory when the test has been made in the larger way commercially. Barrel plating is of necessity a commercial proposition. Therefore, to get good and uniform results daily, much study and careful scrutinizing of every move from the loading of the work into the baskets for cleaning, to the final drying out and boxing, is imperative. In a word, to find the best way to do the work and to maintain it, requires "eternal vigilance." We are living in a progressive age and efficiency counts now perhaps as never before.

The higher cost of materials, steel and all the nonferrous metals, anodes and salts, the higher and still higher labor cost, stimulates and encourages the man who is called upon to "produce the goods" to greater effort and invention in order that the exacting conditions of the present day may be successfully met. The text books on the subject of electroplating give some information on plating by the barrel method, yet most of those that have come to the writer's attention give but little that is coherent and valuable as to practical plating practice along this line. The trade journals have done more to enlighten in this way, and their efforts in this respect are to be commended and the service thus rendered should receive the fullest appreciation of every superintendent and foreman plater.

PREPARATION OF THE WORK

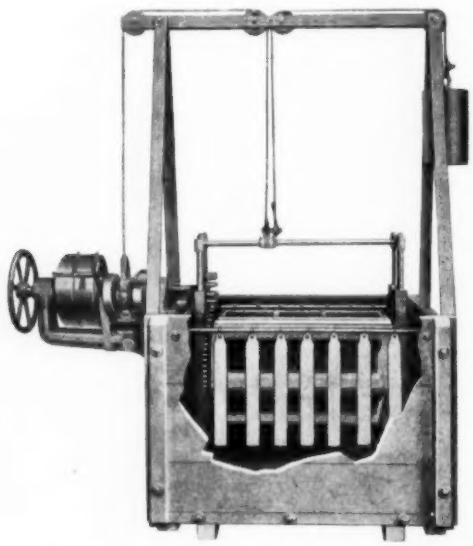
Speaking in a general way, the work that is commonly plated by the barrel method ranges in size from very small screws, nuts, pins, rivets, washers, etc., up to work eight or ten inches in length which is about the limit for the ordinary plating barrel of fourteen by twenty-four inches. Some pieces longer than these can be handled in the thirty inch barrels and of course still longer and larger work in barrels of greater diameter. In preparing work for the plating barrels one very important thing is a suitable basket in which to handle the work through the cleaning operations. Various materials have been used in making these baskets. Experience has shown: (1) That the basket must be strong as it is subject to very hard usage and is often called upon to withstand a load of one hundred pounds or more; (2) It should be easy to handle and therefore not too heavy; (3) It should be practically non-corrosive, not acted upon by the lye bath, the acid pickle or the cyanide dip; (4) It should be open enough to permit a free rinsing and draining of the work.

For a number of years the writer found nothing more satisfactory than baskets made of heavy guage sheet copper perforated for half their depth with various sized holes to accommodate the multiplicity of parts large and small. For nearly two years a better basket has been used which has proved highly satisfactory. This is made of Nichrome wire mesh, reinforced with Nichrome band iron. This material is not acted upon by any acid or alkali, hot or cold, that is used in the plating room and is practically indestructible. The first one of these baskets was put into service two years ago and has seen constant daily service in cleaning and through the mixed acid dips and today is in as good condition as when new, showing no corrosion or wear.

A convenient sized basket for the average run of plating barrel work is ten inches in diameter by fifteen inches deep with a handle fifteen inches high. A basket of this size filled with small work will hold as much as can be conveniently handled by one man. Two of these baskets filled two thirds full will hold a load for the twenty-four inch barrel.

*Remington Typewriter Company, Ilion, N. Y.

In practice it is customary to fill enough of these baskets the last thing before quitting time to load all of the plating barrels for the first round of work the next morning, setting them in the lye bath overnight. A tank 57 x 36 x 30 inches of cast iron or steel is about right for ten or twelve baskets. To keep the baskets from setting on the bottom of the tank and into the accumulation of "mud" (dirt and chips washed out of the work) a frame made of two inch angle iron securely bolted together and well braced, with heavy half inch wire mesh fastened over the entire top is used. This has legs of two inch angle iron eight inches high at each of the corners and on the cross braces. This frame or platform supports the baskets and keeps the handles well out of the bath,



"RELIANCE" MECHANICAL ELECTRO-PLATER.
CHAS. F. L'HOMMEDIEU & SONS CO., CHICAGO, ILL.

also allowing a better circulation of the boiling lye through the work.

The lye bath used is a mixture of caustic and carbonate in the following proportions: Caustic soda, 66 2-3%, Soda ash, 33 1-3% and is kept at about 10 degrees Beaumé. This is found to be very effective as a cleaning bath and I consider more economical than many of the prepared cleaners on the market.

The baskets are taken from the lye bath into a hot water rinse and passed rapidly through a pickle of nitre cake dissolved in water to which is added occasionally some muriatic acid. This pickle is made up to stand at from 15 to 20 degrees Beaumé. This nitre cake or salt cake is sold under various trade names such as "Kleanrite," "Edis Compound," etc., and is a by-product in the manufacture of nitric acid and dynamite. It is quite effective as a pickling agent and apparently helps to clean the work as well as to remove scale and oxidization. After the pickling the work is rinsed thoroughly in cold running water and is then passed through a cyanide dip and again well rinsed in cold running water and set into the last rinsing water which completes the cleaning and rinsing.

The work is now ready for the barrels. These last rinsing tanks are large enough to accommodate six baskets at one time, making it possible to load the plating barrels rapidly. One man usually cleans the work while another loads the barrels and starts them. The arrangement of cleaning tanks and rinses is parallel to the line of plating barrel tanks with a space of eight feet between and has proved to be a very satisfactory arrangement.

LOADING THE BARRELS.

The loading point is opposite to the last rinsing tank and consists of a tank of the same dimensions as the largest plating barrel tanks and is set in line with them. This tank is provided with running water and serves a double purpose. A tray covering the entire top of this tank is hinged to its back. This tray is of wood covered with heavy sheet iron and provided with a fine wire mesh drain near the back edge. It has back and sides three inches high, and is so made that when down on top of the tank it is higher at the front than at the rear, thus allowing all the surplus water to drain back and through the fine wire mesh into the tank.

The barrels are handled by means of a Yale quarter ton chain hoist which is hooked to a four-wheeled trolley which runs upon a single angle iron track suspended from the ceiling by strong hangers at a distance of about five feet above the top of the plating tanks. This track runs the whole length of the line of plating tanks a little to the front of the center of them, thus allowing the barrels to run free of the driving mechanism.

A barrel is placed upon the tray, the basket or baskets dumped into it and the cover firmly fastened on. The operator then raises the barrel clear of the tray and pushes it along the track to the plating tank, lowers it into the solution and starts it, setting the rheostat at proper voltage, repeating the operations outlined here until all the barrels are in.

SPROCKET AND CHAIN DRIVE

A word just here concerning the chain drive. A few years ago nearly all plating barrels were belt driven. Now quite a number of concerns have adopted the chain drive. The writer has found the sprocket and chain with clutch on shaft very satisfactory as compared with the belt drive. With the belts there was always some trouble, belts would stretch and slip and breakages were frequent.

SPEED OF BARRELS

The barrels are arranged to run at two speeds by means of different sized sprockets. One group of barrels is run at five R. P. M. and another group is run at fourteen R. P. M. The purpose of this is to assist in producing differing degrees of finish.

SOURCE OF CURRENT AND REGULATIONS

The system is the three pole or equalizing system and the current control is obtained by means of a central or field rheostat with voltmeter and ammeter. Also each tank is provided with a rheostat, voltmeter and ammeter. The voltage maintained is constant at 6 or 7 volts at central and is cut down where necessary at the tank. A further means of lowering the voltage at the tank is provided by the use of double throw, double pole, switches to cut in from high to low side, providing a moderately wide range of voltage at the tank. A motor generator set ("Optimus"), four and eight volts, two and four thousand amperes furnishes the current.

TIME IN PLATER AND VOLTAGE USED

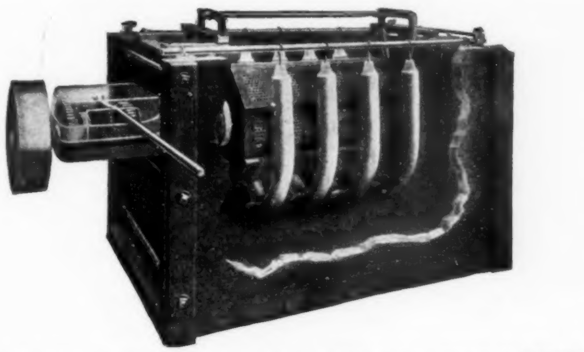
The length of time that work remains in the plating bath varies considerably by reason of the nature of the work and requirements as to the thickness of deposit and finish desired. In practice it is found to range from forty-five minutes to three and one half hours. The voltage at the tanks ranging from six down to three and one half.

The amperage varies widely according to the square inches of surface of work in the barrel, etc., sixty amperes being about the average per barrel.

SOLUTIONS AND ANODES

Regarding the nickel solutions and anodes which give the best results in barrel plating there seems to be some difference of opinion among platers. It is commonly agreed, however, that a solution for barrel plating should be much richer in metal than for still plating. Certain prepared salts have been widely advertised as being particularly effective when used in barrel plating. Some of these have been tried and found wanting. In some instances thirty-two ounces per gallon of water is the formula given. Most of these salts, if not all of them, are bolstered up with chlorides of sodium or ammonium or both.

Where steel and iron mainly are to be plated these



THE HANSON AND VAN WINKLE ELECTRO-PLATING BARREL.

prepared salts are to be avoided, as their use in plating steel and iron will surely cause trouble. As one writer quite recently said, "Chlorides and chlorines are relations that cause bad disturbances in the iron and steel family."

14 ounces of single salts,
4 ounces of magnesium sulphite,
4 ounces of boric acid,
1 gallon of water,

makes a good practical nickel solution for the plating barrel, or

10 ounces of single salts
6 ounces of double salts,
4 ounces of magnesium sulphate,
1 gallon of water

acidulated with sulphuric acid. Both of these have given good satisfaction. The specific gravity of the solution for barrel plating should be 10 to 14 degrees Baumé.

The best anodes are none too good and plenty of them should be used,—twelve curved elliptic anodes to each rod or twenty-four to the tank for the twenty-four inch barrel. It is poor economy to scrimp on anodes. More anodes, fewer salts, should be the practice of the barrel plater.

UNLOADING THE BARRELS, RINSING AND DRYING THE WORK

While discussing these matters our barrels have been running and the work plating. It is now time to take it out, unload the barrels, rinse and dry out the work, which is done after the following manner. The chain hoist is run down the line of vats to the first tank. The operator throws the arm on the rheostat over to "Off," pulls the lever which releases the clutch stopping the barrel, and lifts it out and a little above the top of the tank, drains the solution out and pushes it along to the rinsing tank. The tray is now lifted and thrown back and the operator lowers the barrel into the water and rocks it back and forth to thoroughly wash out the solution. He then hoists it up and out pushing it a little to one side and at the same time lowering the tray to the top of the tank. He then swings the barrel over the tray, takes off the cover and dumps the work. The work is then pulled forward off the front edge of the tray into baskets which are set on a narrow shelf fastened to the tank at the proper height to permit the top edge of the basket to set under the front edge of the tray. As fast as the baskets are filled with the plated work they are removed, rinsed in running water, then put through a weak pickle of sulphuric acid and water, then into cold water, then hot water to the drying barrel.

THE NONESUCH PLATING BARREL MADE BY THE MUNNING-LOEB COMPANY, MATTEAWAN, N. J.

THE DRYING BARREL

A steam jacketed oblique tumbler ("Baird") is used to dry the plated work as well as much other work that is washed or tumbled. The work is dumped into this barrel with sawdust. This is done while the barrel is in motion. After several revolutions of the barrel it is lowered while running to a point just over the sieve, which is held in an iron frame hinged to braces on the floor and extending over a box which is a little larger than the sieve and about eight inches deep, large enough to carry a good supply of sawdust. As the sawdust and work roll out of the heated tumbler the operator starts the compressed air pump which is attached to the frame carrying the sieve and in a moment or two the sawdust is sifted out and the hot, dry and clean work is ready to be placed in the box provided for it. This the operator does by lifting the sieve out and placing one end on the edge of the box, dumps the work into it. This is all done in a very few moments and there is never any question as to whether the work is dry no matter how difficult it may be to dry. Only a small amount of sawdust is required. Before replacing the sieve in the shaker frame the operator shovels enough sawdust into the barrel for the next batch of work, bringing the barrel back into position to receive it.

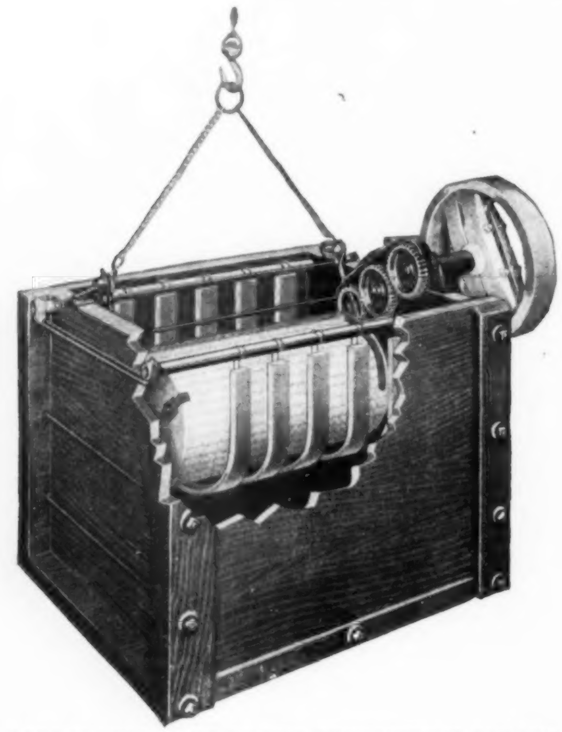
While this has been going on the plating barrel just emptied has again been loaded, placed in the tank and started. Three men handle this outfit of ten plating barrels, also taking care of a wet tumbling barrel section including seven tumblers and two ball burnishing barrels, turning out a large amount of work.

PLATING BARRELS

The plating barrels operated are of the Hanson and Van Winkle and Nonesuch make and are mostly fitted with celluloid panels with 1-8 x 1-20 inch perforations as much of the work handled is very small. The writer can speak highly of these barrels as well as some others which he is more or less familiar with. Several types of plating barrels are advertised. The manufacturers' claims for these various types are interesting but not always are they found as perfect as claimed and the writer has already stated his belief that the ideal plating barrel outfit has not yet been built. Each type of barrel

has distinct advantages and, be it noted, disadvantages.

To determine which is best suited to his purpose the consumer should give careful consideration to these things as very soon indeed after beginning to do barrel plating the matter of repairs and upkeep comes to the front. A strong recommendation for a plating barrel outfit is low cost of repairs and upkeep and the practicability of making the necessary repairs "on the job."



THE ROTO-PLATER MADE BY THE CONNECTICUT DYNAMO AND MOTOR COMPANY, IRVINGTON, N. J.

The utility of the barrel for the work that is expected of it is another feature which should be well considered.

The manner in which the current is conveyed to the work through the negative pole, i. e., the connection or contact with the work, is a very important thing, for some barrels are very deficient in this respect. The contact should be constant and made in such a manner that the mass in the barrel is broken up and moving all of the time while plating instead of sliding, lodging and catching and as in the case of some barrels fitted with the swinging arm, wedging fast between the arm and the side of the barrel.

THE NEW INTERNAL BARREL OF THE ROTO-PLATER.

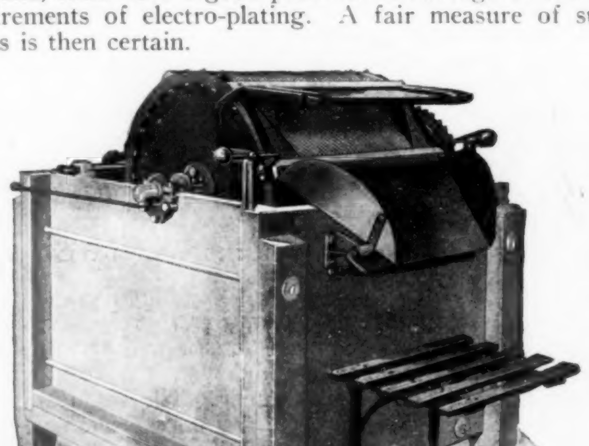
Then as to the question of materials used in the make-up of plating barrels, for five or six years past many materials have been used in making plating barrels, particularly the panels. Compositions of hard rubber, celluloid and Bakelite also canvas have been and are being used. Some are still using wooden barrels. In the experience of the writer all of these have given fairly good service. The best results have been obtained by the use of barrels fitted with celluloid panels. The canvas paneled barrels are fine for plating certain classes of work, notably articles of a light character. The barrels with panels and heads made of bakelite or composition would seem to approach the ideal, as according to the statements of the manufacturers they are "non-conducting, non-absorbing, non-warping and practically indestructible."

The writer has been unable to discover any material difference between the wholly-immersed barrel and the one which is but partly immersed in the character and quality of work turned out. There is an advantage in most instances in being able to get at the inside of the plating barrel, so the writer rather favors the "lift out to empty" barrel, and where the plating barrel is seldom used twice in a day for the same work it is evident that it would not do to be in doubt as to whether or not all of the previous batch had been removed.

However, each establishment where barrel plating is done has its own problems to solve and very likely the plating barrel outfit that is satisfactory in one line of work might not fill the bill in another widely differing line.

Some concerns have built their own plating barrel outfits and have thus secured for themselves what they desired. With the number of plating barrels now on the market to choose from it would seem that something to fill the requirements of every case might be purchased. Among the many may be mentioned the Hanson and Van Winkle, Rotoplater, Boissier, Nonesuch, U. S. Junior, National and Reliance barrels.

In closing the writer desires to express the opinion that one of the principal essentials in the operating of mechanical plating apparatus is that the man in immediate charge shall have, first, good mechanical ability and second, shall have a good practical knowledge of the requirements of electro-plating. A fair measure of success is then certain.



U. S. JUNIOR ELECTRO-PLATER MADE BY U. S. GALVANIZING COMPANY, BROOKLYN, N. Y.

ALUMINUM CASTINGS AND FORGINGS *

A Report of the Use of Manganese as a Hardening Compound in Aluminum.

By P. E. McKinney.†

In the manufacture of light castings the following properties might be cited as most desirable.

(a) Low specific gravity.

(b) A fair amount of strength and freedom from brittleness.

(c) Good machining properties.

(d) The maximum resistance to corrosion.

(e) Good casting qualities and freedom from hot shortness.

It is a well-known fact that pure aluminum is entirely too soft to produce satisfactory castings for most purposes and it is the universal practice to stiffen up the alloy with some hardening element. Probably the most widely used hardener for aluminum is copper, which is used at the rate of about 8 per cent. of copper to 92 per cent. of aluminum. Zinc and tin are also frequently used as hardeners. The use of these hardeners is attended with some well recognized objections. In the first place, the addition of from 8 per cent. to 10 per cent. of hardener partially defeats the purpose of using aluminum in that the specific gravity is materially increased. The hardened metal while fairly strong has a strong tendency to brittleness and the alloys are in most cases less resistant to corrosion than either of the component metals. Hot shortness in the case of intricate castings is another feature attendant to the use of these hardeners.

In the Ninth Annual Report of the Alloys Research Committee Dr. W. Rosenhain and Mr. F. C. A. H. Lantsberry have published some very interesting data on the influence of manganese on aluminum alloys, which demonstrates beyond a doubt that these combinations have great promise in the production of light alloys. Various combinations containing manganese with or without copper and with a minimum aluminum contest of 95 per cent. have been used in actual foundry practices for the past two years with the most gratifying results. The use of manganese in relatively small quantities hardens and strengthens the alloy without destroying its ductility as is the case with copper or zinc. The machining properties are excellent and the comparatively small amount of hardener used makes possible a specific gravity in the finished alloy from .35 to .40 less than that of the ordinary No. 8 alloy. When properly made these alloys are practically free from hot shortness and the most intricate castings can be produced with comparative ease.

The statement has frequently been made that for the successful production of good aluminum alloys it is necessary to have available special melting furnaces and devices for handling the metal. This has not been found to be the case in handling the alloys of aluminum containing manganese which can be melted in natural draft pit furnaces, provided ordinary precautions are used in melting and fluxing the metal. The most satisfactory method of introducing the hardening elements is first, by alloying them with a small amount of aluminum, making a rich hardener of definite proportions and comparatively low melting point.

The most dangerous impurities encountered in aluminum alloys are carbon, silicon and iron, hence, the greatest precaution should be taken to prevent introduction of these impurities either in the metal used or through the medium of crucibles and tools. With this in view carbonless manganese produced by the Thermit process has been used exclusively for this purpose. This is alloyed with copper when aluminum-copper-manganese is being made by melting 60 per cent. copper and introducing 40 per cent. of manganese in small pieces heating until the two metals have combined, which is seen by the smooth condition of the surface of the metal. This alloy can then be diluted with an equal weight of aluminum to reduce the melting point, although it is perfectly feasible to use copper-manganese direct. In making the alloy of manganese without copper, 80 per cent. aluminum is first melted, brought to a bright cherry red and 20 per cent. manganese added in very small pieces. The alloy should be poured as soon as the manganese is all dissolved.

In melting aluminum alloys clay crucibles or clay-lined crucibles are preferable. No charcoal or carbonaceous covering is used on the metal as carbon combines with this alloy, forming a very brittle compound. Gates and sprues from castings must be carefully cleaned and freed from sand, as practically all the sand introduced into the pot is reduced to silicon, which materially weakens the alloy. In cases where there is danger of introducing sand into the crucible it has been found very beneficial to introduce a powdered flux which is made by melting together 60 per cent. of potassium chloride and 40 per cent. of kryolite and powdering the mixture. This flux tends to dissolve the silica and keeps it from combining with the aluminum.

In preparing the alloy for casting purposes an empty crucible is set in the furnace and heated to a bright red heat. The requisite amount of hardening alloy is added and melted as quickly as possible. As soon as the hardener is melted the draft is cut down by opening the cover of the furnace and aluminum is added in small increments as fast as it will melt, timing the additions so as to keep the temperature of the mixture at not more than a faint red heat. The crucible is drawn from the furnace just before the last of the aluminum is melted in order to prevent the metal becoming overheated. This is a very important point, as overheated aluminum will absorb silica from the walls of the crucible at a very rapid rate, and it has been found that once overheated this aluminum is practically worthless for future use. Just before pouring there is added to contents of crucible about one-fourth ounce zinc chloride and the metal is thoroughly stirred with a clay covered skimmer. This zinc salt tends to reduce the oxides and dross in the metal and puts it in ideal condition for casting purposes. Alloys of aluminum containing manganese have a slightly greater shrinkage than those containing copper alone, and due allowance must be made by using ample risers and chill plates on intricate castings.

The elastic ratio of this alloy as determined by the drop of the beam of the testing machine will average about 60 per cent. of ultimate strength.

The fracture of test specimens is silky and shows considerable toughness instead of being granular and brittle as is the case with many aluminum alloys. Castings are practically free from hot shortness and it has been found to be perfectly feasible to make castings with very thin webs without any trouble due to this

*U. S. Naval Gun Factory, Washington, D. C.

†A paper presented at the annual meeting of the American Institute of Metals, September 11-15, 1916, at Cleveland, Ohio.

cause. Alloys of aluminum containing manganese have been found to work very freely either by cold rolling or hot forging, and many intricate shaped drop forgings have been produced by its use.

The following are results of tensile tests of coupons from sand cast aluminum castings taken at random from recent heats:

COMPOSITION.

Manganese, 1.50%; copper, 2.00%; aluminum, 96.00%.

Tensile strength lbs. per sq. in.	Elongation % in 2 inches
22,000	15.0%
22,000	14.0%
21,000	8.0%
19,000	9.5%
19,000	14.7%
19,000	14.0%
21,000	13.0%
22,000	12.0%
24,000	10.0%
19,000	12.0%
18,000	13.0%
11/226	11/135.2

10.37

In preparing the alloy for forging ~~purposes~~ the same precautions are observed in melting and pouring the ingots as in the case of sand castings. The same type of ingot molds as are used for bronze forging ingots are suitable for aluminum. The ingot molds are heated to about 500 degrees F. and given a thin coating of orange shellac to produce a clean skin. The metal should be carefully skimmed and poured very quickly in order to prevent cold shots due to the low temperature at which it must be poured.

In making drop forgings from aluminum a little preliminary forging is very desirable. The ingot can be cut or cropped to the desired lengths and forged to approximate shape at a temperature of from 1,150 degrees F. to 1,400 degrees F. after which they can be finished in the dies. These alloys flow with ease during forging and dies have been found to fill very nicely in all cases. Forging dies of the same type as are used for tobin bronze forgings are perfectly satisfactory for aluminum work.

The stiffness and strength of the forged material can be controlled by varying the finishing temperature. Considerable stiffness and elasticity can be imparted to the forgings by two or three blows of the forging dies at about 500 degrees F.

The following are typical physical properties obtained on bars of this alloy forged to one inch square and turned to standard size tensile specimens

Soft alloy containing:

Manganese, 1.00%; copper, 2.00%; aluminum, 96.50%.

	Tensile Strength	Yield Point	Elongation	Reduction
Cold finished	27,750	27,750	12.00	47.00
Hot finished	21,083	12,223	26.7	48.7
Intermediate	25,617	22,918	17.4	52.00

Hard alloy containing:

Manganese, 2.00%; copper, 3.00%; aluminum, 94.50%.

	Tensile Strength	Yield Point	Elongation	Reduction
Cold finished	31,930	30,000	9.75	35.3
Cold finished	34,123	33,000	4.00	11.25
Cold finished	30,405	30,000	11.25	30.78
Hot finished	27,450	15,000	21.95	56.0
Intermediate	28,670	22,000	21.00	50.4

Sections cut from thin drop forgings which were cold finished have shown tensile strength as high as 40,000 pounds per square inch. The forged material machines very nicely and shows a fine silky fracture when broken. The increased density of the metal produced by forging makes it a great deal more resistant to sea water corrosion than the cast alloy. Several drop forgings of these alloys are now undergoing service tests on ships at sea to determine their resistance to corrosion and reports thus far received are very promising.

Considering the low specific gravity of these alloys together with the strength and ductility obtainable, the material compares very favorably with the heavier bronze and brass forging materials for many purposes.

MANUFACTURE OF STERLING SILVER

Our advice has been asked regarding the following questions in the manufacture of sterling silver ware.

First—In the manufacture of sterling novelties, do the large concerns have a method of keeping out fire stains, or rather preventing the oxidization of the copper in the alloy which is ordinarily removed by an acid dip, etc., during the operation of soldering, particularly when the work is made of thin stock?

Second—(a) What is the general method of polishing sterling flatware? (b) What kind and size bobbs and buffs are used? (c) About what time is consumed in polishing operations on a plain polished handle and bowl teaspoon?

Three—(a) Are the dies for stamping the handles on sterling spoons so constructed as to leave no barb? (b) Are the edges of the spoon flat punched through burnishing dies?

Four—What is the most up-to-date method for lacquering sterling flatware?

Fifth—What percentage of nickel silver is best suited for spinning?

We would answer the above as follows:

First—In the manufacture of soldered sterling silver novelties made from thin stock we do not know of any method of eliminating the fire scale except by the use of acids.

Second—(a) The general method of polishing sterling silver flatware is done on walrus or on buff wheels, using ground pumice stone of suitable grade mixed with lard oil as the abrasive to get the required finish. (b) The time consumed on polishing the handles and bowls of tea spoons depends largely on the operator. A first class operator with a good lathe and equipment should be able to finish two bowls and handles of from three to four gross of tea spoons in nine hours.

Third—In general manufacture the spoon and fork blanks are cut out to the required shape before stamping the pattern or design on the handles. The stamping operation leaves a thin burr or fin around the edges of the handles. This burr or fin is removed in the operation of trimming which is usually done on belts or wheels so shaped as to follow the outline of the handles as left from the stamping dies. These wheels or belts are coated with a very fine emery or other abrasive which removes the burr or fin and leaves the edges of the handles the proper shape and fine enough for finishing in the polishing.

Four—Manufacturers of sterling silver flatware use both the spray and brush processes of lacquering.

Fifth—In the matter of best percentage of nickel silver for spinning, the metal manufacturers make several grades of metal for this purpose—10, 12, 14 and 18 per cent., all having their place according to the grade of goods to be made. The larger proportion of hollow ware and similar goods is made from 18 per cent. nickel silver where a first class article is desired.—C. W. C.

A PLATER'S RECOLLECTION

Some Serious Information Regarding the Finishing of Metals Told in Breezy Style.

Written for The Metal Industry by Joseph Birbaum.

(Continued from November, 1916.)

A PLOT.

Shortly before Joe was taken into another department a conspiracy took place of which the blackest gang of black hands would be proud of. Mike, alias "Shakespeare," colored up the plated work. "Shakespeare" earned this nickname on account of poetical inclination. His undoing was when he fell in love with the lacquerer's red headed daughter (not the lacquerer's daughter of the Egyptian catalog). How the gang suffered from his poetical outburst. Everything looked red and rosy to "Shakespeare." Once the brass plating was too red, next time the bronze or gold was too red and on nickel plated parts he regularly managed to find the copper plating under the nickel. He butchered the plating frightfully until the foreman went up to him and said, "Mike, you either get married or come back down to earth out of that seventh heaven; if not you can go still further down. Making love poetry and coloring up don't harmonize."

"Oh, shucks, he is only sore because he cannot make rhymes" burst out "Shakespeare" after Hoehm's departure. "If he can make a poem by noon I will quit straddling Pegasus."

The foreman was advised at once and a gentlemen's agreement was reached whereby the gang who acted as jurors pledged themselves to turn in a verdict in his favor. Noon arrived and the predestined doom of "Shakespeare" as shop poet finally arrived in the following:

LIVE WIRES

Galvani, Volta and Ampere
Are the ones to whom I owe
That as plater I am here;
Also to Davy, Carlisle, Ohm.

The galvano-plastic's father
Is Spencer, Jordan or Jacobi.
Those who brought the art yet farther
Are Boetcher, Roseleur and Smee.

De Ruotz, Wright and Faraday,
Brugnatelli, Watt, Wallaston,
All gave us in their own way
Discoveries to work on.

Even Fritz, for some discovery.
Yes! even him some praise is due.
After ardent search and worry
He found by him a long lost—screw.

The gang realized that they committed a near crime by dubbing this a first class poem, but in accord with the agreement the verdict was rendered in favor of Mr. Hoehm and thus assassinated the noble poetical spirit of Mike "Shakespeare," the shop poet.

Fritz's face, which first radiated like a ten pound lump of radium after he heard his name associated with all of these great geniuses of electro chemistry, gradually assumed the proportions of a stretched out rubber band after he assimilated the last line. It took a long time before he consoled himself with the thought that one evil gone is better than the spectre of evil roaming and also that "Shakespeare" had a better chance rhyming while shining than shining by rhyming.

TUMBLING PROCESSES.

"You can use all your skyrocket language and engineer ascensions in the tumbling room, no one will be the wiser, until you get on to the game of polishing by means of these barrels. You will have to spend some time in here and be of help to John."

"Gosh," interjected Joe; "I'm glad to have an opportunity to spend something on the princely salary I'm getting."

"Never mind. Hey! John, please take care of Joe for a few weeks, until he is on." Thus began a period of truck and shovel, accompanied by the inharmonious music of the rattling drums.

"Maybe you think there is nothing to this tumbling job," said John, "wait and see; first, I polish more work than a hundred and one polishers; secondly, you got to know how and the how of it. I'm going to show you."

Mass-polishing articles by means of tumbling barrels is the first automatic polishing process known to the electro-plater, hence we are justified in ranking the tumbling barrel as the first automatic polishing apparatus. These barrels are an adaption of the foundry rattler which was originally used to remove the mold sand from small castings. Gradually the possibilities of these rolling barrels developed, but where the foundry had originally only one aim, the removing of the sand, the plater was quick to grasp the enormous economical possibilities and to see in this process the means of automatic polishing of cheaper grades of goods.

Two tumbling processes are in use today in the plating industry, wet and dry (please, do not accuse me of raising the liquor or prohibition question here, I am neutral). As there are different ways of tumbling, so also have we a variety of barrels, cylinders ranging from 1 to 3 foot diameter by 2 to 6 foot lengths, box or square rattlers, egg, hexagon, octagon, tapered and drum shaped tilting barrels. Invariably the question arises, which is best?

The foundry method of rattling is of a simple nature. The sand-covered work is loaded together with tumbling stars, or smaller castings mixed together with larger ones and is then kept in motion until all sand is removed, this usually ends the operation as far as the foundry is concerned.

Quite different is the tumbling method for polishing castings for plating and it requires considerable time. In the first operation, or water milling, the water-tight tumbler is filled with the castings to be polished together with sharp sand, clinkers or any other sharp and cheap cutting material, water and a small amount of sal soda to prevent possible rusting of the castings in deep pores or depressions when the barrel is not in motion over night. The running time of a charge is absolutely determined by the roughness of the castings, or, on the other hand, the smoothness of the finish desired; on many jobs cutting material has to be added repeatedly as it is bound to mill into fine grained sand and thereby losses its grinding or cutting power.

Arrived at the desired smoothness, the castings are flushed clean, then run dry in the same barrel to avoid unnecessary extra handling. In place of cutting material, sawdust and coarse shavings are added, these act as coloring or brightening agents. Although great care must be taken in polishing castings by means of rattling

barrels, the same is the case in tumbling stampings in regards to loading, but the tumbling of stampings is quite different.

Then the tumbling barrel usually had a cylinder of an average of about 1½ to 3 feet in dimensions. Keen competition and the desire for progress arose in the plating industry and tumbling in line with modern electro-plating has undergone radical changes until the plater now is operating barrels which have a capacity of over 20,000 pieces with an actual plating area of 300,000 to 350,000 square inches.

A roller of this kind can, of course, not be economically rotated by a center shaft such as the smaller cylinders but rests on rollers and is driven by a gear 3½ feet in diameter, the drum is smaller on both ends, end diameter being 3 feet, the center, 5 feet and length 7 feet. Several distinct advantages are derived in this style, enormous power economy in the manner of mounting and driving, double motion of rolling, thereby reducing the running time, and rapid emptying of the charge as the goods slide towards the lowest point where the doors are located. Naturally you realize that rattlers of this style will not of necessity have to be of above measurments but can be constructed in proportionally smaller dimensions and still produce all previous mentioned advantages.

Stampings made of hot roller steel generally are covered with a hard blue scale which is best to remove in a hot pickle of 10 per cent. sulphuric acid with bichromate of potash added. This will not only cut the scale but also the grease and oil adhering to stampings. Oil might be a fine medium to quiet troubled water but causes quite some trouble in the pickling waters, when used as a lubricant for drawing and forming stampings. It is advisable to resort to lubricants for this purpose which are soluble in water. As oil is not soluble in a common pickle it clings to the stampings, retards quick and uniform pickling and when run through an alkaline neutralizing solution, hydrolizes, and then can cause endless worry in subsequent plating operations. The articles apparently are tumbled nice and bright but an exacting and minute inspection will disclose a dark film. This coating has been repeatedly attributed to overpickled stock, or improper cleaning, in tumbling nine-tenths of this trouble can be traced to saponified grease and oil. Wherever this condition is present it prolongs tumbling and is removed very slowly in the dry tumbling process, since there is no other action than the mechanical. In other words, merely a wiping and absorbing process through the mediums of sawdust, leather meal or leather skivings. The insufficient tumbling theory is, therefore, not correct, since the goods have been tumbled the proper allotted time and under experienced hands. Oily or greasy stampings are quickly cleaned in the regular tumbling process when not pickled, but as soon as treated in acid and alkali solutions such lubricators become obstinate on account of being saponified.

Articles of this kind, although given a high polish, usually have a darker appearance, and a close examination after a thorough cleaning in a soda or potash bath will show the right color of the steel and prove these contentions. Therefore, remember this, so that you may recall it when in need. Three different ways have been pointed out to overcome this difficulty; first, the application of a soluble lubricating compound for blanking, drawing and forming in the press room; second, the use of a grease dissolving pickle, and third, the mechanical removal of the oil before pickling. Inasmuch as the old proverb, "An ounce of prevention is better than a pound of cure," is still true, the first method is the correct, since these compounds do not only avoid trouble, but are also cheaper than oil. The second increases the expenditure for chemicals and the third for labor and power as it requires an extra tumbling operation.

At this very moment I remember another interesting factor of pickling, and as one enlightened progressive and efficient plater found it of mighty importance I can not fail to mention it before going back to the subject of tumbling. About 30,000 pieces were pickled in a separate vat, in the meantime another vat was filled with an equal amount, then the pickling solution was drawn by means of an acid-proof pump from the first into the second vat, the pickled articles then were carried on a conveyor to an ingenious devised washing and drying machine which consisted of a series of drums running in hot water and alkali solution connected to a gas heated drum. The goods were automatically discharged from one drum into another and finally into barrels. One man was able to do the work of four, and this with ease too, and apparently the millenium of pickling had arrived, but wait. The tumbling was accomplished by the dry process and done absolutely correct, still, a large amount of work would, in the plating, show dark spots which were almost impossible to plate. The man in charge of tumbling was blamed first. He then doubled his efforts to turn out good work, but still the same trouble occurred. "I'm doing all I can," he said, "but the pickler don't pickle the stuff enough."

The goods were then kept in the pickle a longer period, still the same trouble occurred again. The articles were tried again with no better results, but instead of insufficient pickling they accused him of overpickling, which by then became a fact. Back and forth it went, the articles were passed around in fine style until the foreman took a hand. He pickled and he tumbled, the results were—nit. The same trouble as before happened—yes, that foreman has gray hair, whether his hair became gray since that time I do not know, but it is sufficient to know that he settled down to use his brains and—found the cause.

It is a well known fact that in the present age discoveries and inventions are the product of good learning and application of science, combined with deep thinking, and not a product of mere chance. This foreman-plater planned and designed that apparatus and could not afford to fall down now. Inquiries and investigation showed the steel to be the same, so the cause did not lay there. The tumbling and the plating were the same, and the pickling, yes, that was done different so it must be there, and there it was.

Rust proofing of steel and iron is done in muffles or furnaces, as for instance in the Bower Barff, Bradlay, or Bontempi processes, or by a slow corrosion of the objects to be thusly treated by applying rust producing chemicals such as iron chloride, nitric acid set. The objects coated over with a film of red oxide of iron are then treated in moist heat, steam, or in boiling water, thereby converting the red oxide into a black oxide of iron, ferric oxide. This oxide, according to duration and repetition of the process, penetrates into the steel and possesses the property to resist further rusting, and moreover the successful application of electro-deposits. About one-fourth of the goods so pickled were exposed too long to the action of the air after the drawing off of the pickle, a slight film of red oxide formed with heavier spots on some parts, rolling through a succession of hot rinsing baths and the drying drum converted this red oxide into black oxide of iron and thereby caused the troublesome spots.

However, the cause once located, the remedy was simple—an additional drum was attached at the head of the apparatus running in a lead-lined tank containing 40 parts muriatic acid and 60 parts water. This deoxidizing bath immediately attacked the film of moist rust and discharged the articles in a white state into the rinsing and neutralizing drums, thereby eliminating all trouble. Even going so far as to re-establish peace between the warring tumbler and pickler, and the foreman-plater again resumed to whistle, "This is the Life." Incidentally I am wondering whether now they have not dubbed this tub, "The Oscar II."

Dry tumbling on a large scale should be done in perforated drums to permit the escape of the grindings, dirt and oil absorbed, for in closed drums these remain in the barrel and the steel grindings and dirt are milled right into the stampings and retard a clean and bright finish which in turn, of course, hinders rapid and inexpensive plating. When a barrel is loaded add sawdust, leather meal, or leather grindings and run the load about two hours. Refill again with absorbents, and repeat this same a third time after another two hours. After which let the barrel roll without any further additions until the goods are ground smooth enough to suit the requirements. Then fill with leather skivings to produce the final polish. Perhaps your inquisitive spirit compels you to ask, what is he referring to by the term leather grindings? They are nothing more nor less than the familiar leather-meal and is a by-product of your tumbling barrel when the right material is used.

Skivings of shoe soles, such as tanneries produce, are rather fussy and soft and make an elegant buffing material which slowly grinds into pulp. This leather pulp leaves the tumbler through the perforations and can be used over and over again until soaked up with oil and dirt, after which it should be discarded. Great care should be exercised in regards to this leather meal, when ready to be discarded, as it contains millions of particles of iron dust which, in combination with oil, makes it highly combustible and therefore a danger to property. Many serious factory fires have had their origin in spontaneous combustion of this material and it should not, when no longer useful, be left laying under the tumblers or kept about the plant but be sent to the boiler room where it will give up its useful ghost in heat units that are creative and not destructive.

But to come back to our real subject, above we said, "Then fill with leather skivings to produce the final polish." When making this final addition of leather, the barrel should be filled therewith chucked full, this prevents further violent friction and grinding of metal on metal and gradually turns into a mild buffing of the articles and so it will be seen that proper tumbling consists of three actions: first, removing of lubricants; second, grinding, and third, buffing.

Tumbling barrels ought to be filled about three-fourths of their capacity, however this three-fourths filling must not be taken literally when actually filling. Most work has a tendency to pack, therefore it is best to fill over three-fourths full, for after running awhile you will find the load reduced in bulk. The loading of a barrel is the first thing to a pay attention to, as with a smaller load the goods are liable to bend, fold, or hammer burrs on the edges; especially the latter is an indication of improper loading and can be noticed time and again more so on heavier gauge steel, whereas lighter gauges are apt to crumple up under heavy blows.

True enough, the running time is shortened with a smaller load since a more violent action takes place, but this advantage is usually offset by slightly damaged work; hence there is nothing gained by this practice.

The work should roll freely but not violently. Here even the ear will give you notice of a proper load and speed, a continuous shatter indicates correct conditions, whereas an intermittent ratch! ratch! would indicate incorrect conditions. The speed of a barrel is determined by the diameter of the tumbler, the larger the barrel, the slower the speed. A standard can be established by setting the speed of a 2½-foot diameter barrel at 44 revolutions per minute and reducing the speed one-half revolution for each additional inch of diameter, or increasing the speed correspondingly for each inch smaller than the set standard. The varying diameter of the tumblers are the cause why speeds are recommended ranging from 30 to 70 revolutions per minute, but following this standard you will find all tumbling barrels giving uniform and excellent results.

Where mechanical platers are operated in conjunction and work is going through that has a tendency to nest, it is advisable to mix one or, at the most, two other kinds with such objects to keep them apart, the mixing of more than two or three kinds I can not recommend as there would be too much time lost sorting them in the lacquering or sacking departments. To prevent damage to goods diligence should be used so as not to mix very heavy stamping with light ones as the latter would surely be crushed under the heavy weight.

(To be continued.)

UP-KEEP OF BRASS SOLUTIONS

The up-keep of brass solutions is a simple proposition if it is taken into consideration that there are three important factors in the make-up of a brass solution, namely: cyanide, copper and zinc. The sodium salts are merely reducing or conducting agents, the ammonia being used for bringing up the zinc and clear the solution and the arsenic, used in minute proportions, to clarify or brighten the deposit. So the up-keep of a brass solution should be based upon the following additions: First, cyanide; second, concentrated solution of copper cyanide in sodium cyanide; third, addition of zinc cyanide in sodium cyanide in very small proportions to maintain the color of the deposit; fourth, occasional additions of ammonium carbonate in proportions of ¼ ounce per gallon.

In maintaining brass solutions in constant operation it should be remembered that copper should always be added first to such a solution when metal is required, as this metal always predominates in a brass deposit, frequently as high as 4 of copper to 1 part of zinc. Even when the brass deposit shows reddish or bronze tones copper should be added because such uneven tones always indicate lack of copper. It is surprising how little zinc is actually required to maintain a brass solution in continuous operation if brass anodes are used and regular additions of cyanide of copper in cyanide and ammonium carbonate are used.

Brass founders' alloys will produce a bronze metal known as extrusion metal or architectural bronze with a composition of 56 per cent. copper and 44 per cent. zinc. To produce a brass, such proportions would have to be 66 to 70 per cent. of copper and 34 to 30 per cent. of zinc. By noting such effects in brass or bronze alloys it may be readily seen that when a brass solution deposits copperish or bronzish tones the addition of copper will produce a true brass. If platers will study the founders' alloys they will soon be able to overcome the difficulties experienced in obtaining successful results in brass plating.—C. H. P.

THE BRASS FOUNDRY *

A RETROSPECTION OF THIRTY YEARS' EXPERIENCE AS A FOUNDRYMAN.

BY E. A. BARNES.†

In the brass foundry, as it existed thirty years ago, whether it was a separate institution doing a jobbing business, or an adjunct to a factory or rolling mill, the facilities which the moulders had at their disposal were far short of those available today. Considering the disadvantages under which the earlier brass foundries were operated, the workers in them should be given great credit for the work they were able to turn out.

Thirty years ago the brass foundries had but two choices of fuel, coke and hard coal; whereas today gas, coke, coal, fuel oil and electricity are available, and each, as you well know, has its own particular sphere of usefulness. The Fort Wayne Electric Works, I think, was one of the first electrical companies to adopt fuel oil in its foundry. We at first had to use the oil with much care, and it was necessary to do considerable research work in connection with the use of the oil for the improved furnaces, burners and appliances available today were not then in existence.

A present-day brass foundry would certainly not be considered up-to-date unless it had compressed air for use in blowing off patterns, operating moulding machines, jarring machines and squeezers of various types. Even the individual work bench of the modern brass foundry is equipped with air nozzle and rapping hammer, enabling the workman to get along without assistance from his neighbor, except in special cases.

Modern foundries, too, make use of power-operated moulding machines of many various designs, which, compared to the crude hand-operated machines of earlier days, look as if they might be the last word in foundry advance, and yet we feel that we are only starting to introduce modern labor-saving machines into the foundry.

The value to the brass foundry of an efficiency engineer and chemist is now unquestioned. Especially where the output of the foundry is quite large, the savings to be effected by having a chemist and engineer on the premises to run down troubles, develop special alloys and make suggestions for handling peculiar propositions, are greatly in excess of the salary outlay.

With all our modern foundry equipment and the special services of engineer and chemist, the resourcefulness of the foundry is often taxed to the limit in solving some of the problems encountered. One proposition that was lately put up to our brass foundry was that of producing commercially large quantities of a duplex thermostatic metal. It was necessary to cast or otherwise fuse together a brass alloy and a plate of nickel steel, the alloy to be of such a nature that it would stand rolling down to three-thousandths of an inch thick and even less, and the finished duplex sheet to be exactly 50 per cent. brass and 50 per cent. nickel steel. In order to secure the required results, it was necessary to have control of the casting of the yellow brass, which meant in the first place the necessity of pure copper. Curiously enough, we found only one particular brand of zinc that would give consistently satisfactory results in the alloy. Many experiments were tried, but either the brass cracked into small pieces or became detached from the steel plates; but by persevering in the experiments we finally developed an alloy which has the proper characteristics to stand the rolling and annealing process and remain firmly joined to the nickel steel. Our final result is a perfect metal for the purpose it is designed to fill.

A foundry problem which has many times puzzled us and other foundries, too, no doubt, is, when and where to commence making use of metal patterns for repeat work. Our experience has been that it is best to make a first-class wooden pattern and use it as long as possible. We find that our engineers and designers frequently wish to make certain structural changes in the part after the first castings have been put into use, and since a wooden pattern usually can be much more readily changed than could a metal one, we use the wooden pattern at the start. Any unprotected wooden pattern, however, soon wears and warps, due to the rough treatment the pattern naturally receives; we have, therefore, been on the lookout for some method of increasing the life of the wooden pattern. In this connection we have been experimenting with the "Shoop" metal coating process. With the "Shoop" pistol, copper or lead coating, as desired, can be applied to fragile and even complicated wooden patterns. This metal coating is supposed to render the patterns waterproof and stiffen them up so that they will hold their shape and more successfully resist the wear and tear incident to the moulding process. At this time we have not done enough of this work to pronounce it an absolute success, but the wooden patterns which we have coated by this process, some with the lead and some with copper, have given surprisingly satisfactory results. We believe that it only requires a little more research work to prove this system highly satisfactory and the scheme to use where the cost of metal patterns is not merited and yet, due to extensive use, the ordinary wooden patterns become expensive due to being frequently replaced by new ones.

Another difficult problem with which we have had to contend is the making of aluminum castings, which would take a high polish. This problem developed in connection with the furnishing of parts for therapeutic instruments such as vibrators, etc. We tried all the standard alloys, but the castings invariably were full of small black specks due to gas in the metal. We were absolutely unable to get a satisfactory casting until we added from 8 per cent. to 10 per cent. of tin. In making this aluminum-copper-tin alloy we found it necessary to make up a rich alloy, cast it into bars and add this alloy to the aluminum at the proper time. The use of these eutectic alloys we have found very effective in securing results otherwise difficult to obtain.

The problem of producing brass and aluminum parts which shall be more homogeneous, tough and perfect than could be produced by ordinary casting methods has led to the development of the pressed metal process. Briefly, the process is as follows: A blank of copper or aluminum bar of sufficient size to contain the amount of metal required in the finished part is heated to a fairly high temperature. This hot blank of metal is then forced into a steel mould of the exact

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*A paper presented at the Annual Meeting of the American Institute of Metals, September 11-15, 1916, at Cleveland, Ohio.

†Fort Wayne Foundry & Machine Company, Fort Wayne, Ind.

design and dimensions of the desired metal part. Powerful hydraulic presses, giving pressures from 500 to 2,000 tons per square inch, are used to force the metal into the mold. This enormous pressure raises the temperature of the metal in the blank and causes it to flow into every part of the mould.

The results which are obtained by this process of forming brass and aluminum parts are truly wonderful.

First. The most intricate shape of piece can be formed by this process. Even ordinary newspaper size of letters reproduce perfectly on the finished part.

Second. The pressed metal parts are formed so accurately to size and their surfaces are so smooth that in many cases no machining is required on the part after it comes from the mould.

Third. Where machining is required, the parts are found to machine much more easily than parts cast by any known methods. The cutting tool might almost be said to become sharper when used in cutting the pressed metal. The pressed metal has no tendency to cause the edge of the cutting tool to crumble or break.

Fourth. The pressed metal parts are absolutely free from air and gas holes and sand. Because of the freedom from such gas and air holes, parts such as gas nozzles can be made by this process.

Fifth. The pressed metal parts are much stronger and tougher than parts cast from the metals in question. Pressed metal brass parts are as strong as bronze or English gun metal, and can, therefore, often be substituted.

As regards checking systems and systems of running foundries and cleaning rooms, such systems and methods are being widely exploited in the technical papers. In this literature there is a wealth of information for the foundry superintendent or owner who wishes to keep abreast of such developments. The technical papers are also a reliable source of information on modern foundry appliances such as core ovens, moulding machines, electric and air hoists, electrical and mechanical sand riddles, acetylene and electric cutting appliances, torches, dust collectors, etc. These appliances of course cost money, but in the end they are unquestionably of value in labor-saving and in keeping good workmen satisfied and interested in their work.

Pyrometers for measuring the temperature of the molten metals are indispensable in securing uniformly perfect castings. Where the foreman or melter has to judge the temperature by his eyes, misjudged temperatures resulting in sluggish metal, with consequent porous or otherwise defective castings, are all too frequent, for the light in the foundry easily influences the decision of the melter, as to when the metal has been heated to the correct temperature for pouring. The pyrometers eliminate such errors in judging temperatures and, we believe, therefore, their use cannot be too strongly recommended, especially when particularly good results are expected.

I feel, however, that it is in the melting end of the foundry itself that we must look for the greatest advances in the near future. I believe that all of the present methods of melting will soon be replaced by much more efficient processes, either electrical or burning a gas derived from a fuel oil base by some method of premixing in a retort rather than by pulverizing and dividing the fuel oil and mixing with air which produces the nebulous form of gas now used. The advances that have been made in electrical furnaces, ovens and retorts lead me to expect that in the near future, electricity will compete on favorable terms with the various fuels for foundry melting purposes. I believe there is no doubt that some of the great electrical men are investigating along these lines and the results of their research should be disclosed in the near future.

"Safety" in the foundry we are glad to note has become an accomplished fact in all of our more modern foundries. A stock of goggles, aprons, leggings and special shoes for foundry work is usually kept in the works' storeroom. In some cases these supplies are checked out to the workmen, while in other foundries they are sold to the men at actual cost; in most cases the use of this special safety clothing is insisted upon by the foundry management, and there is no question that it is a practice that all foundries should follow.

A DEFINITION OF "SWEEPINGS"

A recent decision of the Board of General Appraisers giving a definition as to the meaning of "Sweepings" as related to the metal trade will be of interest to refiners of the United States as well as to the manufacturing jewelers, silversmiths and platers in Canada.

The test case before the customs tribunal was in the name of Handy & Harman of Bridgeport, Conn., the firm's importations consisting of material designated as silver chloride. It was classified by the Collector at 10 per cent. under Paragraph 65, reading "salts and all other compounds and mixtures of which silver constitutes the element of chief value." Free entry under Paragraph 565 was claimed by the importers.

This paragraph specifies "ores of gold, silver, or nickel and nickel matte; ores of the platinum metals; sweepings of gold and silver." The importers' plant manager testified that he solicited certain waste material from manufacturing jewelers, silversmiths and silver plate companies all over the United States and Canada, for the purpose of extracting and reclaiming the silver contained in the refuse. He said the term "sweepings," as understood in the trade, covered such material as polishings, floorings, bench sweeps, filings, chlorides, wash water, buff wastings, solutions, crucibles and slags; in fact, any such refuse carrying sufficient silver to make the reclamation worth while, including silver chlorides. The witness distinguished these waste chlorides known as sweepings containing about 25 per cent. of silver, from the chemically pure chlorides, which, he said, carried about 75 per cent. of silver.

This testimony was corroborated by two other silver refiners of long business experience extending over all sections of the United States. All the witnesses agreed that the materials had no commercial use except to recover the gold, silver or other materials contained therein.

Judge Brown, in his decision for the board, said that Paragraph 65, under which the Collector made classification, was intended to cover salts of silver and other metals used in commerce or the laboratory as such and not articles which, arising as waste from some manufacturing process, were not used in that condition, but were used chiefly to reclaim the silver or other metallic content therein.

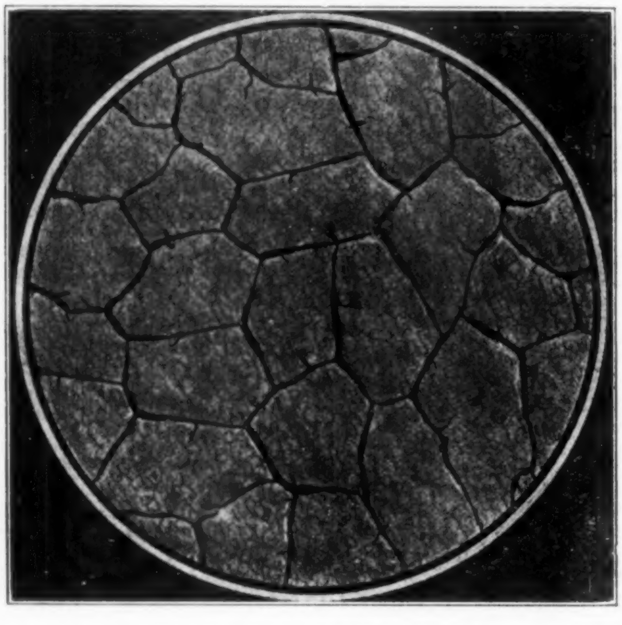
The General Appraiser held that the importers had made out a trade definition of the term "sweepings" which would include the merchandise in question. In conclusion, he said it seemed plain that Congress in placing silver and other ores on the free list in Paragraph 565 by adding the term "sweepings" intended to include all siver refuse or waste material which, like the ore, would be only useful for reclaiming the silver. The Collector was reversed.

CUPRO-NICKEL: ITS MICRO-STRUCTURE.

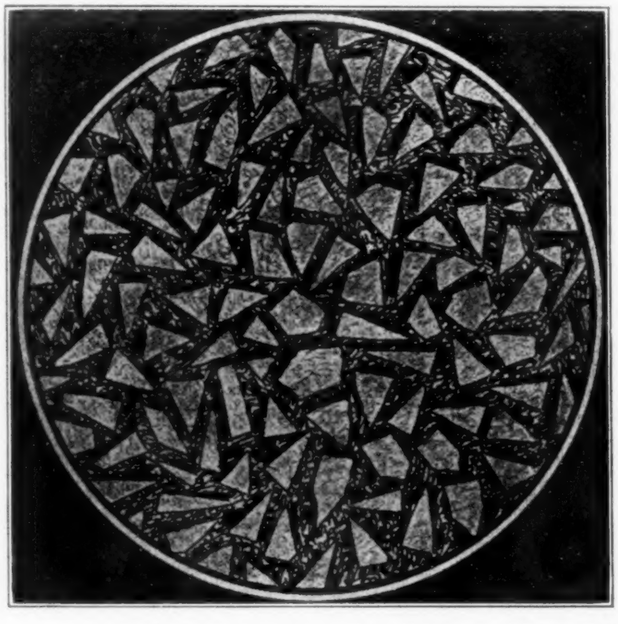
AN INTERESTING INVESTIGATION MADE UPON METAL MADE FROM "ALL SCRAP."

WRITTEN FOR THE METAL INDUSTRY BY JAMES SCOTT.

The alloy known as cupro-nickel, or copper-nickel, is now being used in enormous quantities, for the casing or capping of the leaden contents of rifle bullets, and is therefore of great importance. Considering that it finally becomes so much waste material after firing, its initial cost of manufacture is worth attention, and incidentally has led to experiments aimed at cheapening its production. Varying degrees of success, or otherwise, have resulted from these trials, but the samples which I handled and tested for the purpose of preparing this article, were evidently quite satisfactory in composition, strength, and so on, and were made from scrap metal, which has hitherto been widely regarded as unsuitable in this direction.



NO. 1.—MAGNIFIED SURFACE OF CUPRO-NICKEL AFTER SLIGHT ETCHING WITH ACID FERRIC CHLORIDE. DIAMETER, ABOUT 1-24TH INCH.



NO. 2.—MAGNIFIED SURFACE OF CUPRO-NICKEL AFTER DEEPER ETCHING WITH ACID FERRIC CHLORIDE. DIAMETER, ABOUT 1-24TH INCH.

The illustrations have been prepared from samples of excellent cupro-nickel made and supplied by Mr. J. Reardon, of Birmingham, from scrap metal. This maker has been providing it, for bullet capping, to a large munition firm over a period of six months, without having received a single complaint concerning it. The only conclusion that can in consequence be formed is that the alloy is quite as good as that made from virgin metals, although its price is only about two-thirds that of the latter.

Monel metal is a cupro-nickel to which about 5 per cent. of iron and manganese are added, thereby conferring extraordinary properties upon it. The formula is copper, 28; nickel, 67; and iron and manganese, 5.

The presence of nickel increases the electrical resistance of copper. The maximum percentage of nickel for this utilitarian purpose is 40, and the alloy containing it is that known as constantour.

Magnetic changes occur in the nickel at about 300° C. in representative alloys, the further addition of copper reducing the degrees correspondingly.

German cupro-nickel coins contain copper 75 per cent. and nickel 25 per cent.; while American cupro-nickel coins contain copper 88 per cent., and nickel 12 per cent.

The whitest cupro-nickel alloy has 57.15 per cent. copper and 42-85 per cent. nickel.

The addition of zinc to cupro-nickel renders the alloy easier to cast, but it then becomes less resistant to various chemical influences, and is practically converted into German or nickel silver. As these remarks are confined to cupro-nickel, this phase will not be further treated upon, except to point out that when an alloy is called nickel bronze it customarily consists of copper 60 per cent., nickel 20 per cent., zinc, 12 per cent., and tin 8 per cent.

Copper and nickel are miscible in one another in the liquid state, in all proportions, and yield a series of mixed crystals—or, as they are alternately called, solid solutions—but no eutectic nor chemical compounds.

Theoretically, according to the opinions of some dental metallurgists, cupro-nickel is an amalgam, in which the nickel is free; but the subject cannot be dealt with on these lines at present. Strictly speaking, an amalgam is a mercury alloy, so that the term is really a restricted one.

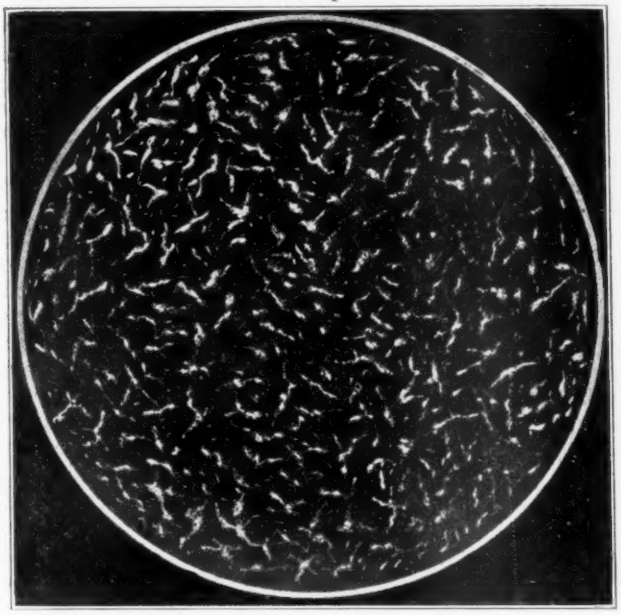
Cupro-nickel, on account of its valuable properties, is highly serviceable as a protection for other metals where bulk or weight is required without the whole of the substance being necessarily of superior quality. The capping of rifle bullets usually has about 30 per cent. nickel, the remainder being copper.

This alloy is originally hard and brittle, and can be compactly rolled or drawn. It possesses very high tensile strength and extreme ductility. It is not affected by the atmosphere, nor do organic acids corrode it.

Many metal workers have contended that it is impossible to produce a high-grade cupro-nickel from scrap metal. Facts are simply stated in this description, without any desire to enter into arguments.

In all the cupro-nickel alloys those parts which first crystallise are richer in nickel than those which become completely solid during later stages, these being conversely, more coppery in composition. If the cooling is moderately rapid, the proportion of nickel in each minute grain decreases gradually from the centre outwards, where the least of it is situated. This disposition explains the cored appearance often noticeable on etched, or suitably heat tinted surfaces. Perfect equilibrium is usually obtained when the alloy is annealed, and the result is then quite uniform, as is proved by the intact, polygonal structure revealed by the microscope.

During the investigations into the features of this special cupro-nickel, a piece of the fresh polished metal was placed in a solution of acid ferric chloride—this is one of the best etching reagents employed by metallurgists—for a short time, and then withdrawn and thoroughly washed. Some of the solution was then poured away, and the dried alloy replaced upright in it,



NO. 3—MAGNIFIED SURFACE OF CUPRO-NICKEL AFTER PROLONGED ETCHING WITH ACID FERRIC CHLORIDE. DIAMETER, ABOUT 1-24TH INCH.

providing in this way for a portion of the metal to be bitten into to a deeper extent. It was afterwards removed a second time, and again washed, dried, and put back, but into a lower amount of the solution. There was thus obtained an example showing their distinct modifications, representing etchings to slight, medium, and extreme degrees, respectively, and affording in consequence a very good insight into the crystalline texture of the alloy.

The colors caused by etching are pale greyish in mild instances, ranging through darker shades the longer the metal is operated on, until a very deep slaty tint is obtained. There are generally intermediate patches (unless it has been completely immersed in the solution) indicating the parts where the surface of the fluid is raised upon the surfaces of the metal by capillary attractions, the chemical action then becoming rather different from that of the remainder, owing probably to quicker molecular changes in the thinned connected films thus occasioned.

The first effect of etching cupro-nickel in acid ferric chloride is the disclosure of a netting of lines, as depicted in No. 1, indicating the junctions of its polygonal grains, some of which approach symmetry of shape, while the outlines of the remainder are somewhat irregular or wavy. To the microscopist such a formation demonstrates the existence of a definite, compact, uniform structure—a kind of miniature mosaic of neatly fitting, strongly cohesive particles.

Additional etching eats away the borders of these grains with fair directness until crystalline planes stand up boldly in the surrounding area, as depicted in No. 2. In the case under observation there was a distinct tendency for the grains to assume a triangular aspect. The solution, in acting upon the larger grains previously referred to, cut cross channels in them simultaneously with their reduction in comparative dimensions, thereby developing the smaller, more shapely ones.

A continuation of this process consumed the preceding crystals except for certain stronger contents, which were left in skeleton relief, as depicted in No. 3. Here we see what might be termed the nuclei, kernels or cores of the grains joined up together by means of outspreading filaments, which act as a support to the lot. As is to be expected, the under etching is less systematic than that described, because the surface layers of the metal interfere with the soaking of the etching solutions; but upon cleaning and polishing the alloy, until a smooth, level, and even surface is regained, the tests can be repeated with the same results.

It is advisable to bear in mind that the nominal crystallizations of pure copper are as octahedra and rhombic dodecahedra, while those of pure nickel are octahedra and cubes.

Melting them together naturally affects the formations. Cleavages naturally give distinctive outlines, which do not always, however, denote the shape of the primary forms.

RAPID COOLING ON ALUMINUM BRONZE.

To determine the effect of rapid cooling on the specific gravity and hardness of alloys of copper and aluminum the following experiment was carried out. The alloy selected for the test contained copper 89.5 per cent. and aluminum 10.5 per cent., by analysis. The copper was melted under a cover of charcoal to protect it from oxidation, and when perfectly fluid the aluminum was gradually added, after which the whole was thoroughly stirred. One casting was made in a green sand mould, the latter being inclined, with the gate carried to the lower end and a heavy riser at the highest end; the bronze thus quietly entered the mould and flowed uphill into the riser. The size of the bar was 1½ in. square by 5 in. in length and the casting was perfectly clean and sound, with faint crystalline markings on the surface. The chilled bar was cast in a carbon mould, and was made vertically, being run from the bottom, with no risers. The size of the bar was 1½ in. square, and 5 in. long. The samples were taken from the lower end of each ingot, the results being as follows:

Specific gravity of sand cast car, 7.43; Brinnell hardness, using 500 kilogramme load, equalled 103.

Specific gravity of chill cast bar, 7.45; Brinnell hardness equalled 104.

The experiment showed that there was no particular advantage to be gained by chilling this alloy as far as the physical properties are concerned, although an immense advantage is gained by the judicious use of chilling with a view to causing the casting to solidify with greater rapidity than the risers or feeders, thus ensuring castings free from shrinkage cavities.

THE RECLAMATION OF BRASS ASHES *

An Exhaustive Treatise on the Handling of Foundry Metal-Bearing Refuse.

By Arthur F. Taggart†.

The recovery of the valuable part of the so-called waste product of manufacturing plants is deservedly becoming of great importance as the prices of raw materials continue their upward climb. In some plants, notably those of the meat packing industry, it is said with justifiable pride that nothing escapes but the worthless odors and useless squeals. In the brass industry such a boast cannot, unfortunately, be substantiated. The fumes that escape are malodorous, but valuable, and the squeal which should mark the loss in the ashes is often absent. It is with the recovery of the valuable metal and unburned fuel from these ashes that the present paper deals. There are methods of recovering the vaporized and oxidized metallic products from the fumes, but they are neither as simple nor as fully understood as the method of ash treatment, and the financial return which they make is not a tithe of that made by a well designed metal reclaiming plant.

TABLE 1.

SIZING-ASSAY TEST OF TYPICAL BRASS ASHES.

Screen Aperture mm.	Weight, gm.	Tons per 100 Tons	Assay % Copper	Tons Copper per 100 Tons
50.8	41,880	10.41	20.2	2.10
26.67	92,740	23.00	5.4	1.24
18.85	51,758	12.85	2.9	0.37
13.33	77,146	19.14	7.5	1.44
6.680	45,264	11.22	9.9	1.11
1.651	31,488	7.81	18.0	1.40
0.833	12,753	3.17	19.9	0.63
0.208	9,761	2.42	23.2	0.56
Through 0.208	40,167	9.98	12.0	1.20
Totals,	402,957	100.00	...	10.05

A sizing-assay test of a typical casting shop ash is given in Table 1. This shows 10.05% copper, which on the basis of a 65-35 brass means 4.5% zinc. A sorting test on this material showed about 15% unburned and partially burned coal. This is for normal operation. Under the stress of maximum production, which is the present condition in all brass plants, the metallic content in the casting shop ashes has, to the writer's knowledge, run up to 25% and the coal to 30% of the total ash. In normal times and at ordinary prices for copper, spelter and coal, the gross value of these casting shop ashes per ton is:

Copper, 10%, 200 lbs. at 13c	$26.00
Zinc, 5.4%, 108 lbs. at 6c	6.48
Coal, 15%, 300 lbs. at $2 (50% original B. t. u)	.30
Total	$32.78

Under present (June, 1916) conditions of forced production and high material prices, the value of the ashes is:

Metal, 25%, 500 lbs. at 20c	$100.00
Coal, 30%, 600 lbs. at $3	.90
Total	$100.90

The method of recovering these values varies in different plants, according to the size of the plant and the consequent production of ashes, and according also to the technical talent available. A small number of small plants sell directly to local junk dealers, others ship to custom scrap metal plants; the large majority treat the ashes by some crude method to recover the coarse metal, some of these selling the fine residue at absurdly low prices, the others using it for filling in low ground around the plant. Finally there are a few of the larger companies that treat the ashes in modern, well-designed reclaiming plants, obtaining as products clean coarse metal which can be melted directly into ingots, and fine rich concentrate which is smelted on the ground and which also yields ingot metal.

It is not necessary to enter far into the contracts between the brass manufacturer and the junk dealer or custom smelting plant to find that but a small part of the values in such ashes go back into the manufacturer's pocket. In none of these contracts is anything allowed for coal or zinc; in many of them zinc is penalized.

Considerable may be said concerning the crude reclaiming plants common in connection with many brass factories. They consist usually of a picking floor or table, from which coarse metal and lump coal are removed, followed by a grinder with restricted discharge (Chilean and Huntington mills, Krupp ball mills, Hill and Williams crushers, etc.). A part of the residue from the picking table is charged into the grinder and the grinder is run until the discharge through the screen has practically ceased, then it is stopped and the cleaned metal which has accumulated within it is more or less laboriously removed. This process is then repeated as often as is necessary to clean up the accumulation of ashes. The fine product from the grinder is usually run over a shaking table of the Wilfley type, from which a dirty concentrate is recovered. The tailing of the table goes to a settling tank or pond, the overflow of which goes to the river or the sewer. The material settling in the tank is sold for what it will bring. Fig. 1 presents a flow-sheet of such a plant.

The following analysis of this procedure shows its lack of economy. Products 1 and 3 are more difficult to melt in crucibles than ingot metal, their composition is uncertain, the oxidation of zinc is excessive, and the slag which adheres to the brass in product 1 and is mixed with the metal in product 3 attacks the crucibles vigorously. The coarse coal (product 2) returns full value. Figuring in the treatment charge, product 4 is paid for on the basis of about 60% of the copper content, less a penalty for zinc. In other words, the smelter pays for a part only of the copper which it can recover, and it charges the seller with the zinc for which he has already paid a good round price. This product also has to stand a stiff freight charge, and, being fine, it holds a considerable quantity of water on which the shipper pays freight, but for which he gets no return. Product 6 has carried many a ton of valuable metal into the sewers and stream beds of the brass manufacturing districts. Notwithstanding the fact that it rarely runs less than 7% or 8% metal and frequently carries 10% to 15%, it is rarely sampled by the metallurgist and its burden of waste is disregarded in presenting the results of the plant. The most cursory examination of any enlargement of the channel in which it flows will show such a

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deposition of rich material, due to the temporary slowing down of the carrying current, as should carry conviction to the most prejudiced mind. The character of product 5, the settled sand tailing from the shaking table, is best presented by the sizing-sorting-assay test given in Table 2. This particular product was sold at $1 per load (about 1.5 tons). On examination it showed 4.23% copper, 2.3% zinc and 23.6% coal coarser than 2.362 mm. Of the metal, 85% is easily recoverable in a well designed concentration plant, and of the concentrate thus recovered, 97% of the copper and 15% of the zinc can be saved in a reverberatory furnace, properly constructed and operated. The resulting ingot metal will contain about 92% copper and 8% zinc. The amount of iron present will depend on the method of concentration and the fluxes used in the furnace. The value of the metal recovered will be $8.72 per ton of original settled sand product in normal times, $18.35 at present metal prices. The cost of recovery should not exceed $2 per ton of material, leaving from $6.72 to $16.35 per ton net in this product which was sold for less than $1 per ton. The flow-sheet followed in Fig. 1 also resulted in grinding up and losing more than 450 lbs. of coal per ton of ashes. By a proper method of treatment practically all of this coal could have been saved, and the money thus recovered would have gone far toward paying the cost of such treatment.

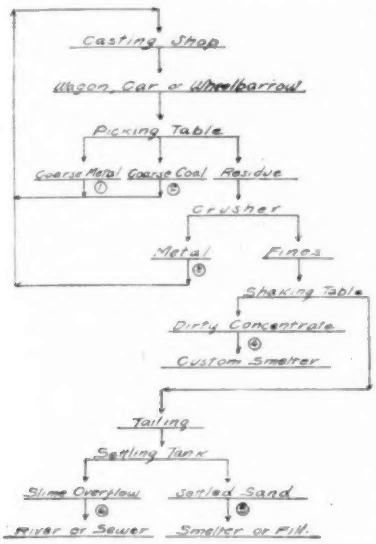

FIG. 1. FLOW SHEET OF A RECLAMATION PROCESS THAT IS NOT ECONOMICAL.

TABLE 2.

SIZING-SORTING-ASSAY TEST ON TYPICAL PRODUCT 5, FIG. 1.

			Brass			Slag			Coal
On Screen Aperture mm.	Weight, gm.	Tons per 100 Tons.	Tons per 100 Tons.	Assay, % Copper.	Tons Copper per 100 Tons.	Tons per 100 Tons.	Assay, % Copper.	Tons Copper per 100 Tons.	Tons per 100 Tons.
18.85	80	1.21	0.063	60.0	0.0378	0.512	2.63	0.0135	0.635
13.33	220	3.33	0.000	...	0.0000	0.380	1.88	0.0071	2.950
9.423	282	4.27	0.000	...	0.0000	0.640	1.47	0.0094	3.630
6.680	420	6.36	0.010	16.70	0.0017	1.580	0.56	0.0088	4.770
4.699	402	6.09	0.040	64.93	0.0259	1.810	1.27	0.0230	4.240
3.327	410	6.21	0.080	65.6	0.0525	2.490	1.37	0.0341	3.640
2.362*	415	6.30	0.110	70.5	0.0775	2.500	2.53	0.0633	3.690
1.651	402	6.09	0.520	54.8	0.2850	5.570	1.67	0.0930	....
1.168	325	4.92	0.800	46.7	0.3735	4.120	0.56	0.0231	....
0.833	332	5.03	0.970	52.8	0.5120	4.060	1.77	0.0718	....
0.589	375	5.68	1.040	55.8	0.5802	4.640	4.31	0.2000	....
0.417	372	5.67	0.270	48.7	0.1315	5.400	3.08	0.1664	....
0.295	418	6.31	0.680	51.7	0.3518	5.630	3.04	0.1711	....
0.208	490	7.42	0.640	35.9	0.2297	6.780	1.50	0.1016	....
0.147	577	8.74	0.480	35.5	0.1704	8.260	0.66	0.0545	....
0.104	513	7.77	0.250	37.0	0.0925	7.520	1.27	0.0955	....
0.074	235	3.56	0.220	28.8	0.0634	3.340	0.76	0.0178	....
through 0.074	330	5.04	0.110	32.7	0.0360	4.930	1.07	0.0528	....
Totals	6,598	100.00	6.283	....	3.0214	70.162	....	1.2068	23.555

*Coal not sorted below this screen.

In the following pages is given an analysis of the problem presented in the reclamation of brass ashes with a solution which has been successfully applied under the direction of the writer and his associates.

The factors which must be considered in the design of such a plant are:

1. The character of the ashes.
2. The quantity of ashes.
3. The treatment of the products of the concentrating plant.
4. The characteristics of the machinery to be employed.
5. Costs, both capital and operating, and their effect on percentages of recovery.

The general system of handling these factors, once they are determined, is by the method of "cut-and-try." The first step is to make a sizing-sorting-assay test of the original ashes. From this is gained necessary information concerning the distribution of metallic values and coal and the amount of slag that must be ground. Grinding, sorting and microscopic tests on the slag afford knowledge as to the distribution and size of the metallic shot which it contains and thus tell to what extent comminution must be carried in order to free for concentration the economic maximum of metal. From the knowledge thus gained an experimental flow-sheet or mill scheme is built up in the laboratory and a test run made to confirm the deductions from the original test. With the further knowledge gained from this test run, and, if necessary, subsequent test runs, a tentative flow-sheet for the mill installation is drawn up. This scheme must be examined critically from the point of view of economical operation, and a balance struck between capital charges and operating coasts for the particular quantity of ashes available for daily treatment. It is best to outline the tentative flow-sheet without consideration of the tonnage to be treated, with the aim only of maximum recovery, and estimate the capital and operating costs of this installation. Then by successive elimination of one machine after another and corresponding revision of cost figures and recovery percentages a point will be finally reached which promises maximum financial return. This is not work for a metallurgist inexperienced in construction. The choice of a grinder not specifically suited to the work in hand or the installation of a handling device, elevator or conveyor, of the wrong size or running at the wrong speed, will

generally mean the difference between success and failure in a plant that may be otherwise well designed. Originally this information must must be gained by careful experimental work on the part of the designer, but fortunately there is sufficient similarity in the various problems arising in the design of reclamation plants to allow the engineer to apply experience gained elsewhere to a large part of the work. When a new problem arises it should be made the subject of careful experimental work before proceeding further.

In Fig. 2 is given a tentative flow-sheet for a plant to treat casting shop ashes ranging in size from 4 in. down to dust and containing 15% to 20% metal and 25% to 30% unburned and partially burned coal. A study of this flow-sheet will show that certain fundamental principles leading to a maximum recovery have been followed. No material containing free metal, i. e., metal with no adhering slag, has been sent to a crusher. This means no unnecessary grinding of metal, which would produce fine metallic flakes difficult to recover. No coal is ground. Only the slag

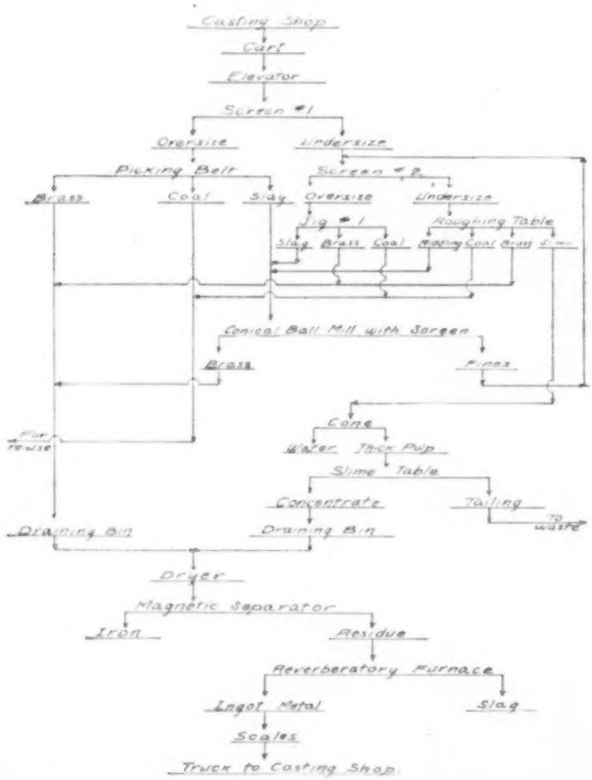

FIG. 2. A FLOW SHEET OF A SIMPLE AND EFFICIENT PLANT.

which contains included metal shot is sent to the grinders. No material is thrown away until it has been ground to the finest size. This is done because microscopic examination of the slag has shown included shot in slag particles as small as 0.005 in. diameter. Handling the ashes and products is automatic throughout. The material is weighed and sampled as it enters the plant, the tailing is sampled automatically, and the coal and brass are weighed, so that intelligent direction of the operation is possible. Such a plant as this can be made to discharge tailing containing not more than one-half of one per cent. metallic copper, which gives a recovery high up in the nineties. With a leaner feed the tenor of the tailing can be lowered somewhat, but so high a percentage of recovery cannot be expected.

A plant so elaborate as the one just outlined should not be installed to treat less than 5 tons of ashes per hour. For smaller tonnages the number of screens and jigs should be reduced by increasing the sieve interval, bearing in mind, however, that such a change will be made at the expense of the character of the product. The jig following the rougher may be eliminated as may also the Wilfley table and the conical pebble mill. In the smelting plant one dryer may be eliminated and the reverberatory furnace may be made to serve both for melting the coarse brass and smelting the fine concentrate by providing proper storage capacity for intermittent operation. Weigh-

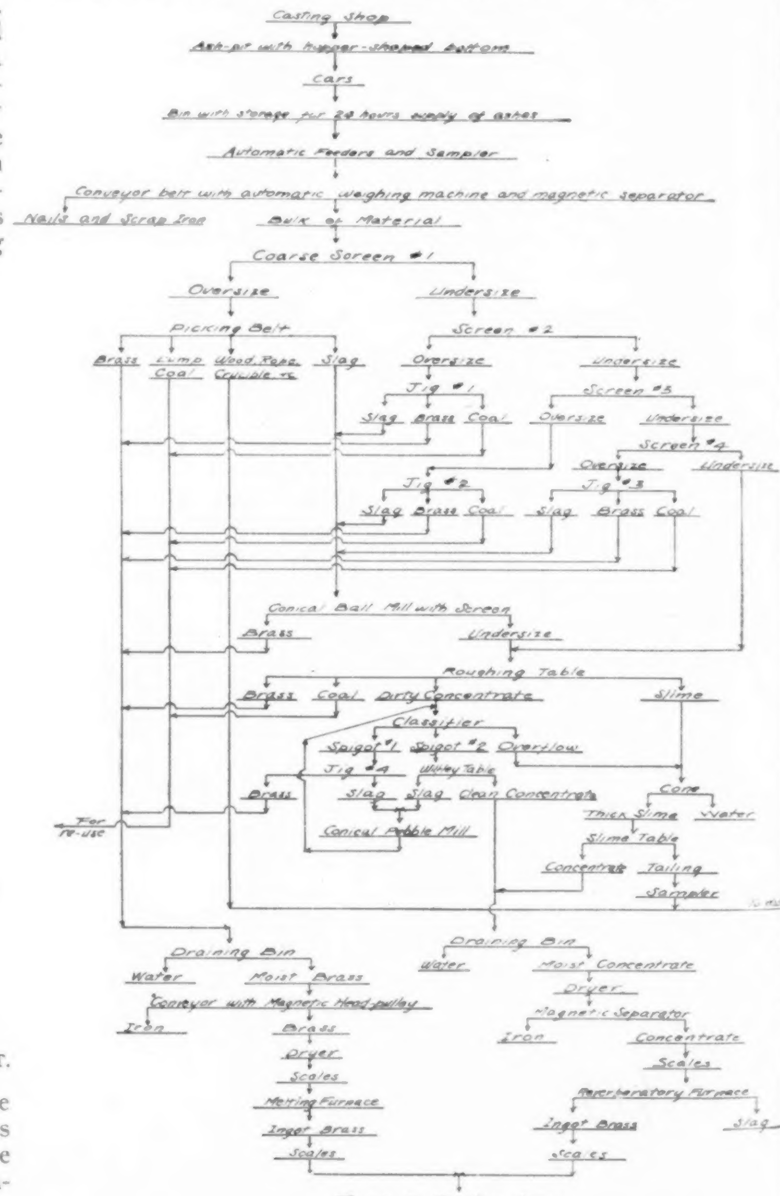

FIG. 3. TENTATIVE FLOW SHEET OF COMPLETE PLANT TO TREAT 5 TONS OF ASHES PER HOUR.

ing devices and preliminary storage may also be sacrificed, but at the expense of smooth running, intelligent operation. Such a simplified plant is outlined in Fig. 3.

The costs of the plants above outlined will depend, of course, on the character of the housing. The smaller plant, with a capacity of 20 tons per day, housed in a wooden building, will cost $15,000 to $20,000; the larger, with a capacity up to 200 tons per day, housed in a steel building, will cost $80,000 to $100,000.

THE MANUFACTURE OF BRONZE POWDER

An Illustrated Description of Its Production in Germany and Its Industrial Uses.

Written for The Metal Industry by Otto Von-Schlenk.

The term "bronze powder" is generally applied to an extremely finely divided metal-powder. It must be distinguished from coarser powder or from granulated metal. Strictly speaking, "bronze powder" is not a powder at all; but if examined under the microscope, it will be seen to consist of very fine "flakes"—i. e., of the finest leaf metal disintegrated into microscopically small pieces. The thickness of these pieces varies between 1-50,000 inch and 1-100,000 inch, while the length and breadth may be anything from 5 to 25 times their thickness. One pound of the very finest bronze powder contains about 1,000,000,000 to 2,000,000,000 particles. The essential difference between bronze powder and granulated metal is in the shape of the particles. The very finest granulated metal consists (as seen under the microscope) of nearly spherical particles with one or two sharp ends (pear or sausage shaped). Their three dimensions are approximately alike. Hence the number of particles in a given quantity of bronze powder is about 50 to 150 times as great as in the same quantity of granulated powder. This fact explains at once both the very great covering power of bronze powder, if used as paint, and the difficulties connected with its manufacture.

The principal materials used for the manufacture of bronze powders (apart from gold and silver used in the manufacture of real gold and silver bronzes) are:—

Copper.
Brass and bronze.
Alluminum.
Zinc.
Tin.
Alloys.

There are at present more than 50 different bronze-powders on the market. The three principal groups are:—

(1) Gold (bronze powders).
(2) Aluminum (silver) bronze powders.
(3) Copper bronze powders.
(4) Coloured bronze powders.

The powders of the first group are made from brass and bronze only. They include all shades from pale gold to rich gold, from citron yellow to orange, and also some of the green shades. The color of the finished powder is produced by a variation of the alloy composition, and in some cases by tempering the finished powder. The green shades are produced by tempering with the simultaneous action of chemicals. These powders are the most expensive of all (more especially the pale gold) on account of the difficulty in preserving the bright color during the whole of the manufacturing process.

The powders of the second group are made chiefly of aluminum and (in a few cases only) of zinc or tin. They are generally used in their natural state, and but rarely colored (see group 4). These remarks also refer to the third group.

The powders of the fourth group are made of any of the materials mentioned, and are either colored by tempering and chemical treatment, or where more brilliant shades, (such as blue, green, pink, etc., are required) are dyed by means of special aniline dyes.

The different methods of coloring will be fully discussed in a subsequent chapter.

APPLICATION OF BRONZE POWDERS.

Bronze powders are used for a great variety of purposes, too numerous even to be mentioned here. We therefore refer to only the more important applications.

When mixed with a suitable binding medium (varnish) bronze powders can be used as an excellent paint for metal goods of all kinds. In the preparation of powders it is generally mixed with very small quantities—from 1-2 to 2 per cent.—of stearine, with which each particle is covered. Stearine, being insoluble in the essence of turpentine which serves as a base for the carrier or binding medium, mounts to the surface of the layer of mixed paint by capillarity. There are then produced between the various molecules constituting the metallic film floating on the surface of the varnish, phenomena of attraction, which cause these molecules to mingle one with the other, so that, when dry, there is formed a continuous metallic coating. It is thanks to this and to the fish scale like shape of the smallest particles that these metallic paints have a covering power far greater than that of ground oxide—base paints.

Bronze paint (gold) is used chiefly for ornamental and decorative purposes in buildings of all kinds. The better qualities are non-tarnishing, and keep their color for many years. They can be easily applied and are also rust-preventing.

Aluminum paint is not only non-corrosive, but is also heat-resisting to a very great degree. It is for this reason used to an ever-increasing extent for painting of all kinds of pipe-lines, engine parts, etc., on board ship. On account of its indifference towards the influence of salt water it is also used for painting ships' fittings. The quantities used for these purposes are very considerable indeed.

Structural iron has been extensively painted in recent years with aluminum paint, and the success attained will encourage and ensure its application for many similar purposes. It may be mentioned that the third stage of the Eiffel Tower (Paris), which was painted prior to 1900, is still in excellent condition; the gas-holder of 1,500,000 cubic feet capacity at the Gennevilliers Works of the Lighting, Heating, and Motor Power Co., painted in 1909, is in a good state of preservation. The paint has been used on several very large pipe-lines of hydraulic power stations. The painting of gasholders would be a distinct improvement and sensibly reduce the cost of their upkeep, at the same time giving an impetus to the aluminum powder industry.

Aluminum paint is, on account of its heat-resisting properties, largely used for painting both pipe-lines and radiators of steam and hot-water heating installations.

The method of heating being much in vogue in the United States, explains why so much powder is exported to America, and why this country was the first to attempt the manufacture of bronze powders.

The painting of lampposts has recently been taken up with considerable success.

A very good protective coating can be given to sheet iron by its immersion in aluminum paint. This finish is very much cheaper than galvanizing, and for many purposes just as good.

A large number of promenade piers at seaside resorts are painted with aluminum; in short, aluminum paint is certainly destined to largely replace other iron and metallic paints. It is more durable, rust-proof, cheaper, and gives a bright and pleasing effect. The ceramic arts and industries are consuming large quantities of all kinds of bronze powders (chiefly pale gold); the same refers to the textile industries, which also use these powders extensively.

Gold and silver bronzes are used for a decoration of picture frames of all kinds; and for finishing numberless fancy articles, ornaments, toys, etc.

Quantities of the finest bronze powders are used for printing and lithographic purposes. The powders are either used in paint form, like other printing inks, or they can be used dry. In this case the actual printing is done with a specially prepared size; the bronze powder is thrown over the newly printed sheet and the superfluous powder removed by air brushes or pneumatic action. These powders are best used for bookbinding purposes, and coarser grades of powder, called "brocade" or "flitter," are used in the manufacture of wall papers.

Apart from all these applications, aluminum powder is used in its dry state for a number of highly important chemical purposes—in the metallurgy of steel and alloys, the manufacture of pryotechnics, and for munitions of war. The quantities used for these purposes are very great in peace times, and enormous in times of war. It is not the object of the author in his series of articles to discuss details of such applications.

RAW MATERIALS.

The manufacture of bronze powders had its origin in the manufacture of real gold bronze, which is a very old industry. Gold bronze is made from the waste (trimmings of gold lead (gold-beaters' waste). This gold leaf being extremely thin, is torn into very minute fragments by special devices, and afterwards ground into a very fine powder.

Until about the years 1860-1865, all metal bronze powders were manufactured by the same method. The metal (brass, bronze, aluminum, etc.) was cast into small ingots, then rolled into narrow strips, annealed, rolled out again, cut up, and finally beaten by means of special hammers into very fine foil or leaves. The leaf metal thus obtained was cut into small pieces and used as raw material for making the powder. Obviously, this is the ideal method of obtaining very fine powder, as it is only necessary to break up the foil into very small shreds. At the same time it is also clear that it is a very costly process. The making of leaf metal is both tedious and expensive. As the demand for cheap powders increased, various methods were tried to adopt the use of thicker leaf or foil, and eventually experiments were made with the very thin metal sheets. Gradually the original machines used for disintegrating the leaf metal were improved and were made heavier and much more solid, until finally the modern machines were evolved. With the aid of these modern machines, not only metal foil, but also sheet metal (up to 1/8 inch) can be broken up into very fine powder.

Simultaneously various makers tried to use granulated metal or cast metal strips and flakes as raw material. It was obvious that their use would considerably cheapen manufacture. Most of these methods consist in melting the metal or alloy by pouring it when in the liquid state on to the interior surface of a rapidly revolving horizontal metal cylinder. The centrifugal force shapes the liquid metal into wide, thin strips. The higher the speed, the thinner will these strips be, and when cold they are easily scraped or stripped off the cylinder. A device for producing such strips is shown in Fig. 1.

The horizontal shaft *b* is provided with a fast and loose pulley *c*. In the end of the shaft is fixed a drum *a*, open on one side only; *d* is the crucible from which the liquid metal is poured.

Other methods are suitable for producing small flakes; one of these is to pour the liquid metal on a large flat plate.

To produce granulated metal, the liquid metal or alloy is poured into water, or it can be sprayed by means of a jet of liquid of steam.

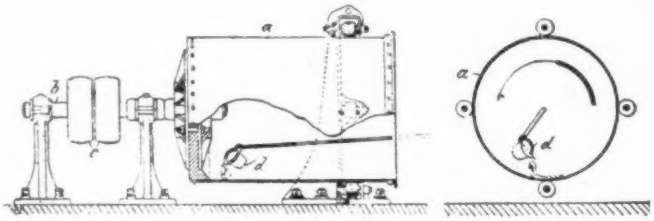

FIG. 1. A DEVICE FOR PRODUCING METAL STRIPS FROM MOLTEN METAL.

These methods can be used for all metals except aluminum. To produce granulated aluminum, two methods can be used. In the first, use is made of the fact that aluminum becomes extremely brittle if heated to about 600°C. Hence aluminum ingots, plates, or scrap is heated to a temperature of 600°C. or molten aluminum is cooled until a temperature of 600° C. is obtained. In the former case the metal must be in such a state that it can easily be pierced by an iron tool. In the latter case, the aluminum must be continually stirred while liquid, so as to introduce into the molten metal as much air as possible. This air produces a very thin film of aluminum oxide round the aluminum particles. In both cases, when a temperature of about 600°C. is obtained, great care must be taken not to let the metal cool down too much during the subsequent operation. In the case of the heated ingots or bars, these can be easily crushed into a comparatively fine powder by mechanical means, but great care must be taken not to attempt to crush too large a piece at a time, as if this is done the metal becomes firm again. In the case of the molten aluminum this is put into a shaking machine immediately after taking it out of the muffle and reduced to powder in this shaking machine.

(To be continued.)

BAUXITE BRICKS FOR FURNACE LININGS.

In a United States Government report on bauxite, W. C. Phalen mentions that this material can be made into bricks for furnace-linings. The purer the material used, the more refractory the resulting brick. Moreover, the addition of bauxite to refractory clays not only increases their content of alumina, but also their refractoriness. The two kinds of bricks in common use, made of hydrous oxide of aluminum, contain 56 and 77 per cent. of alumina respectively. The lower percentage bricks are used as fire-clay bricks, but will withstand higher heat. The bricks containing the higher percentage have been employed as a substitute for magnesia (magnesite) bricks for open-hearth and similar work.

WHAT FIRST-AIDERS CAN DO

A PAGE OF VALUABLE SUGGESTIONS FOR FOUNDRY AND FACTORY TAKEN FROM THE SPIRIT OF CAUTION.*

"There is no good reason why you should have such a sore wrist."

The first-aider keeps on hand materials for first-aid treatment of slight injuries.

Instructions should be posted where they can be read by persons in general.

The best all-round germ-killer for open wounds.

A convenient and compact first-aid kit.

How the wire gauze splint may be arranged for holding both lower and upper arm in position.

FIG. 1—INSPIRATION: PRESSURE OFF

FIG. 2—EXPIRATION: PRESSURE ON

METHOD OF TREATMENT TO RESTORE CONSCIOUSNESS.

* Issued by the Conference Board on Safety and Sanitation, 928 Western avenue, West Lynn, Mass.

EDITORIAL

Vol. 15 NEW YORK, FEBRUARY, 1917 No. 2

THE METAL INDUSTRY

With Which Are Incorporated
THE ALUMINUM WORLD, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS' REVIEW, COPPER AND BRASS.
Published Monthly

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CONTENTS

THE WAR AND METALS

As we go to press diplomatic relations with Germany have been severed. Germany, in her last note made clear that she intended to wage ruthless warfare in defiance of all accepted standards or laws of civilization. This was more than the already sorely tried patiences of the United States could endure and we are now on the brink of war. It is the ardent hope of all, of course, that actual warfare will be averted and there seems to be hope for this. In any event, however, the country is solidly behind the President, and Germany or any other country will find a united AMERICA ready to defend AMERICAN RIGHTS and on the side of JUSTICE and HUMANITY.

It may be a means of shortening the duration of the war should America enter into it, but this no one can foretell. From a metallurgical standpoint this would be most desirable in that it would put an end to wanton destruction and waste of men, materials and metals.

BUYING SHEET BRASS

An interesting sidelight has been thrown on conditions in the brass industry by an incident which was recently brought to our attention. One of the subscribers of THE METAL INDUSTRY called upon us to aid him in obtaining some sheet brass that was essential to his business. The amount was small—only a hundred pounds and the gauge was of ordinary thickness, No. 26. It seems that our subscriber had offered the order to one of our advertisers who stated that he made a specialty of this sort of metal. The order was accepted and a satisfactory price was quoted and a delivery time set. This being done, the consumer waited a reasonable length of time and not hearing anything about his brass began to make inquiries about it, but met with no response. After several weeks of letter writing and telegrams he gave up in dispair and then appealed to us.

The matter was taken up and an inquiry was formulated and sent to all the mills making brass of this character. In due time replies were received, and, out of the lot, there were about a dozen applied to in all, there was only one that evidenced any interest in the matter. This concern, strange to say, was one of the largest in the country and just the one perhaps that could have been excused from answering at all as the order was to be considered too small for it to take any notice of. The replies received were all of a courteous nature. "They were sorry but they were not in a position to quote on the order and hoped at some future time to be not quite so busy and begged for further consideration for future wants."

Supposing that the inquiry had been for a large

amount of metal and for some special mixture and gauge it is in order to speculate whether this one large concern would have been able to entertain the idea of the business and take care of the order. When it is considered that some of the concerns applied to are new in the brass business the incident reveals a remarkable condition and this gives rise to the thought as to how long will the prosperity in the metal business continue and how is the small consumer going to conduct his business so as to be assured that he can get his metal when he needs it and not have to be on the anxious seat for fear he will run short and so be led into overbuying on a rising market?

CORRESPONDENCE AND DISCUSSION

WE CORDIALLY INVITE CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY

CYANIDE SHORTAGE

To the Editor of The Metal Industry:

In your January issue, page 12, there appears an article, "Solving the Cyanide Shortage," by C. B. Wilmore, electro-chemist. Under the present serious conditions of cyanide shortage caused by the power reduction at Niagara Falls, where one of the elements of the cyanide manufacture is produced, articles of this nature are welcome and desirable, our efforts being bent in the same direction as our advertisement on page 62 of the same issue would indicate.

However, the writer of the article seems to be seriously misinformed as to the situation; we mean the position taken by us as manufacturers of cyanide, so far as the price is concerned. If he will take the trouble to look into this question, he will find that today's prices of cyanide, with the exception of small advances, due to the increased cost of raw materials, have remained practically unchanged, and that this company is not taking the smallest advantage of the exceptional condition of the market. Over 90 per cent. of its production of cyanide is delivered and charged direct to consumers, the remainder going to dealers, who, we have every confidence, follow this company's line of policy. There may be a few exceptions; only to these exceptions can the remarks of this article appearing in the second paragraph refer.

As the lack of knowledge by the writer of the actual price situation is so apparent, we would suggest that you send him a copy of this letter, herewith attached, and any further information he may desire as to the prices we shall be pleased to supply to him.

The Roessler & Hasslacher Chemical Company,
V. S. Hamann, Treasurer.

New York, N. Y., January 16, 1917.

To the Editor of The Metal Industry:

I am in receipt of a copy of a letter from a representative of the Roessler & Hasslacher Chemical Company, criticising my article in the January issue, and I wish to thank you for your courtesy in sending me a copy of this letter in advance of its publication.

I wish to remind the writer of this letter that in my article I attacked not a firm, but a general condition of the market.

If the writer of the letter wishes to assume for his firm the responsibility for this condition of the market, as his letter indicates, that of course is his undisputed privilege.

That such a condition of the market as I described existed is too well known among the plating profession to require elaborate proof. My statements as to the prices were based on market reports found in the *New York Commercial*, and in the *Oil, Paint and Drug Reporter*. My statements were based further on the experiences of electro-platers of my acquaintance, who have not been users of metal cyanides, and who have been forced to pay as high as $2 a pound for cyanide.

I wish to quote the following statements as to exportation of cyanide from New York, which appeared in the *Oil, Paint and Drug Reporter* for December 4, 1916, just previous to my writing the article. These figures are for one week:

	Pounds.
To Mexico	39,400
To Honduras	33,600
To Philippine Islands	10,665

The total for this week was 83,665 pounds, or at the rate of over 350,000 pounds per month.

I am glad to have the assurance of the Roessler & Hasslacher Chemical Company, that they, at least, are endeavoring to conserve the nation's supply of cyanide for American manufacturers as it is certain from the export figures just quoted above that somebody in the United States, who has control of extremely large quantities of cyanide, is not acting so loyally towards the American consumers of cyanide.

C. B. Wilmore.

Chicago, Ill., January 31, 1917.

SCRAP REFINING FURNACE

To the Editor of The Metal Industry:

There are about sixty brass and copper mills in this country, and most of them do not know what to do with the scrap that accumulates. I have a furnace for refining brass or copper into ingots that can be built in any mill, and I should be glad to hear from any concern that would be interested in such a furnace.

I may state that this furnace has been worked in Swansea, South Wales, for about a hundred years. A small furnace can be built for holding about six tons of scrap and the same can be used for refining both copper and brass. The cost of building a furnace would not be very much, as the outside can be built of old bricks; the fire bricks would be the only ones that would cost the most. Small coal is used for fuel, and it takes about five tons to run the furnace for twenty-four hours. It would take three men about three hours to ladle the metal out into ingots, or the metal can be run out quickly, and then the furnace could be refilled with scrap ready for the next day's charge. Every mill that is rolling copper or brass should have one of these furnaces on account of the high prices of these metals at this time.

Charles Smith.

Harrison, N. J., January 30, 1917.

NEW BOOKS

THE METAL IINDUSTRY, 1916. Size 9½ by 12 inches. 546 pages, including index. Bound in cloth. Price $1.50. Published and for sale by THE METAL INDUSTRY PUBLISHING COMPANY, 99 John street, New York.

This book is the bound volume of The Metal Industry for the year 1916 and it is safe to say that there are few trade journals which, when bound, will present an equal amount of interesting and valuable reading. The subjects covered by the monthly issues of this journal range from the melting, mixing, and founding of the metals in the casting shop, through the machine shop and manufactory to the finished product embodying such operations as polishing, plating and lacquering. There have also been published a large number of notices relating to the newest and latest methods and appliances relating to the metal trades. There have also been published a number of most instructive articles on chemical and electro-plating engineering; while on the practical side there have been published during the year several hundred shop problems and their answers.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS: JESSE L. JONES, Metallurgical PETER W. BLAIR, Mechanical CHARLES H. PROCTOR, Plating-Chemical

ALLOYING

Q.—What is the effect of sulphur, iron, phosphorus and aluminum on a red brass mixture—85 copper, 5 lead, 5 tin and 5 zinc? Also on yellow brass—67 copper, 33 zinc?

A.—Sulphur is detrimental to both the mixtures named. Its presence causes an alloy to set quickly and this favors the formation of blow-holes. Sulphur unites readily with copper to form a brittle sulphide. This sulphide by segregating about the crystal faces of an alloy may reduce its ductility in a marked degree. While sulphur has been used in acid resisting bronzes of high lead content to prevent separation of the lead which it accomplishes by causing the metal to set quickly, even here its use is open to question as other things could be used that would be less objectionable.

Iron up to 0.25 per cent. is not detrimental to brass mixtures. It is a strengthener and to some extent a deoxidizer and toughener if added designedly and thoroughly alloyed. When it is present in the unalloyed form it is very undesirable and will injure machine tools. Unless it is alloyed well and protected from oxidation by the presence of a small amount of some deoxidizer such as manganese or aluminum, iron in an alloy will on remelting the alloy, oxidize, making black brittle castings.

Phosphorus, while a recognized deoxidizer for bearing bronzes composed of copper, tin and lead, is not desirable in brasses or bronzes that contain zinc. It is common practice to add a small piece of phosphorus to mixtures like the two named, especially if they are made from scrap metals. In the first named alloy, any considerable addition of phosphorus would produce segregation, and in the second it would weaken the alloy as phosphide of copper like the sulphide is very brittle.

Aluminum will whiten the first named alloy and make it more fluid, but on repeated remelting it will be found an undesirable addition and it will make scruffy, porous castings. In yellow brass it is frequently used to promote fluidity and enable light casting to be run.

While special circumstances might justify the addition of phosphorus or aluminum to the two mixtures named, their use is not advised.—J. L. J. Problem 2,400.

CASTING

Q.—Can you give us instructions as to the best and most economical way to pour bronze and babbitt bushings for automobile and high speed work? We want to know the modern method used in pouring to eliminate air holes, dross and other difficulties that make bushings porous.

A.—When bushings for automobile and high speed work are cast in green sand they may be porous because the sand is too wet or because of poorly vented cores. The metal may wash away portions of the mold and the sand may mingle with the metal so that it is unfit for anti-friction uses. The sand may be of such low melting point as to partly fuse and be found adhering or "burned on" the castings so that machining is rendered difficult and expensive. Castings made in sand molds cool very slowly and their crystalline structure may be so coarse that the metal does not have very good anti-frictional quality and it may wear out rapidly.

A method of casting that has been found to give very satisfactory results is the so-called "stock-sticks." Rods of suitable diameter and 2 or 3 ft. long are cast in iron molds. These rods are drilled out and make bearings that are close-grained and of excellent quality. Considerable amounts of turnings are produced by this method, but they can be used over again. The bearings obtained are so excellent that this method is looked on with favor by manufacturers who desire the best.—J. L. J. Problem 2,401.

CLEANING

Q.—We are now cleaning silver plated German silver as it comes from the buffing wheel with a jet of steam. This does the work very well, but we desire to get away from this method. Could you recommend any special solvent?

A.—A solvent for cleaning German silver should be prepared as follows:

Tri-sodium phosphate	25 per cent.
Borax powder	25 " "
Soda ash 58%	50 " "

Prepare a boiling solution and add from 2 to 4 ounces of the above per gallon of water. We believe that this solution will prove effective for your work.—C. H. P. Problem 2,401a.

EXPANDING

Q.—Can you advise us what is the expansion of the non-ferrous metals due to change of temperature?

A.—The expansion, either in length or volume, due to change of temperature, is called the co-efficient of expansion and varies for the same substance at different temperatures. Usually it increases as the temperature increases. The following gives in the correct order the expansion of the different metals, the first possessing the greatest proportion of expansion and the last the least—zinc, lead, solder, tin, brass and copper.

Lead when heated from 32° Fahr. to 212° Fahr., has a linear expansion of 1 inch 360. Obviously this is a small amount, but the results are most serious. A very excellent illustration in order to show the expansibility of copper is to use soldered joints in connection with hot water pipes. No matter how excellent the joints are soldered the unequal expansion and contraction of the solder and copper will cause the joints to leak in a short time, when there is a change from a low to high degree of temperature.—P. W. B. Problem 2,402.

FINISHING

Q.—We have some brass fixtures to wax finish and would like to know which is the best way to put this on. Must the metal be heated and is it brushed or sprayed on?

A.—To produce a wax finish upon a surface of metal such as bank fixtures, etc., the method used should be as follows: Prepare and finish the metal articles to the point of lacquering, but in the place of lacquering prepare a mixture of beeswax with a little caranubia wax, dissolved in turpentine by the aid of heat so that a paste is produced. Apply to the metal surface as thinly as possible with a stiff brush, then polish with canton flannel or woolen cloths. We do not think it is possible to use the wax method in connection with a spray.—C. H. P. Problem 2,403.

MIXING

Q.—Will you be kind enough to inform us what metal or composition can be used for making castings in sand molds which will shrink the most? What we wish to do is to reduce the size of the pattern, which we desire to have smaller

than the original, and thus save the expense of making a new pattern.

A.—Pure aluminum shrinks more than any of the common metals. If you pour the castings with flat gates so placed as not to prevent free shrinkage and have the metal hot you should get a ¼ of an inch shrinkage to the foot.—J. L. J. Problem 2,404.

Q.—Can you advise us what to mix with aluminum to make a casting that will approach the hardness of iron? We wish to make a flat casting about 4 by 6 and ½ inch thick and desire it perfectly flat. The mixture would have to be such that it would not warp in the casting, as we do not wish to do any machining in order to make it flat.

A.—If your plate is 4 x 6 feet and ½ inch thick it is somewhat of a job. The usual No. 12 alloy (copper 7 and aluminum 93) is the best alloy to use, although the No. 63 alloy (zinc 33 and aluminum 67) is very much harder and could be tried if not too brittle. You cannot get hardness and toughness in any one light aluminum alloy. By pouring with four flat gates (or more), as in stove plate practice, with risers in center and observing care in running the mold you ought to get a flat casting.—J. L. J. Problem 2,405.

Q.—In the following formula for manganese bronze, what is the function of the iron, manganese, tin and aluminum? Also, the effect of increasing or decreasing the amount of each? Copper 56, zinc 42, iron 1.5, 80 per cent. ferro-manganese .5, tin 1, aluminum .5.

A.—In a general way it may be said that iron, manganese tin and aluminum act as strengtheners and hardeners in manganese bronze. If the aluminum is omitted from the above mixture and the iron, manganese and tin reduced by half, a mixture is obtained that is not suitable for sand castings, but it is one that is very soft and ductile and adapted for hot rolling. Manganese probably protects the iron of the manganese bronze from oxidation just as it protects iron from oxidation in the manufacture of steel. While both the manganese and aluminum are deoxidizers and ordinarily used in very small amounts, they may both be largely increased, the aluminum to about 8 per cent and the manganese to about 15 per cent, without any diminution of ductility. In fact, alloys with these amounts of aluminum and manganese may be rolled. On the other hand, but slight increases of the tin can be made without excessive hardening of the manganese bronze. While it is possible to vary the percentages of the components of manganese bronze, it is best to adhere rather closely to the formula given if satisfactory results desired.—J. L. J. Problem 2,406.

PLATING

Q.—Kindly publish the amount of current necessary in volts and amperes needed for nickel plating of coppered steel. We have a 5-volt, 500-ampere dynamo. The tank contains a 300-gallon solution of nickel ammonium sulphate. Also state the time required for plating.

A.—A 5-volt, 500-ampere dynamo will produce ample current for nickel-plating from 50 to 60 square feet of surface. If your solution is in good working condition, then 3 to 4 volts will be ample, and the amperage according to the amount of surface to be plated.

If the copper-plated steel is only to have a thin protective coating, and does not have to be polished afterwards, then 10 to 15 minutes will be sufficient. If the articles are to be polished after nickel plating, then 30 to 60 minutes will be required to produce a sufficiently heavy coating.

If the solution is made up with the nickel ammonium sulphate only, then a conducting salt will be repaired. About two ounces of common salt or the same amount of sal ammoniac may be added per gallon of solution for this purpose.—C. H. P. Problem 2,407.

RECOVERING

Q.—We would like to have some information about the use to which exhausted dry cell batteries are put or could be put.

A.—Dry cell batteries are usually made from the following materials: Metallic zinc, carbon, ammonium chloride, zinc chloride and manganese dioxide, which latter material serves as a depolarizer. In the exhausted batteries the zinc can is probably the material sought by those who buy the scrap. It may be corroded until rather thin, but if removed from the battery and melted down in an iron kettle it would have considerable value owing to the present high price of zinc.

The zinc chloride and ammonium chloride unite to form a double salt which is not soluble in water, but which can be removed by washing with dilute hydrochloric acid. The recovered double salt could be used as a galvanizer's flux or for making soldering fluxes. The carbon and manganese dioxide that remain could be roasted, the carbon turned off and the manganese dioxide recovered as such or the carbon and manganese dioxide could be smelted in a blast furnace into ferro-manganese or spiegel. It is not likely that these exhausted batteries could be had in sufficient numbers to make a house to house collection profitable, but in the case of firms which are large users of them are collection would be less expensive.—J. L. J. Problem 2,408.

SOLDERING

Q.—How can aluminum be soldered by using the common solder (50 tin and 50 lead). Also kindly furnish me with full information regarding the best methods for soldering aluminum.

A.—Aluminum cannot be soldered with plumbers' common solder, 50 tin and 50 lead. It is necessary to use aluminum solder. There are a number of these on the market; probably the one most used is: Aluminum 1 part, phosphor tin 1 part, zinc 11 parts and 29 parts of tin. This may be applied with a common heavy soldering copper when soldering light material, such as sheet aluminum, but should be applied with a torch if the work to be soldered is heavy and requires a great deal of heat.

The directions for using aluminum solder are about as follows: Scrape the parts clean as in ordinary soldering work, heat the soldering iron very hot and hold on the aluminum long enough to get the part to be soldered hot so that the solder will flow. Then apply enough flux to cover the part to be soldered and finally apply the aluminum solder. It is better to use two irons so that they can be changed frequently in order to keep the solder hot. The soldering irons should also be heavy as they will retain their heat longer. Some people do not use a flux on new work and only use a blow-pipe in soldering new clean aluminum.—P. W. B. Problem 2,409.

Q.—We would ask for advice on soldering in the bottoms of founts or bowls as used on table lamps and lanterns. These tanks hold gasoline under air pressure and while the tops are brass or copper, the bottoms are terne plate. The bottoms are spun in, the brass sides being lapped about ¼ in. over the edges of the concave lead coated bases.

We would like to know if you think it practicable to sweat these bottoms in by immersing in molten solder and if this method be employed what would be the best flux? Also, what grade of solder you would recommend?

A.—A solder composed of 42 parts tin and 58 parts lead has a low melting point, 181 deg. Centigrade, and would be suitable for this work. In addition, it is less expensive than strictly 50-50 solder. The best flux would be a solution of rosin in alcohol, about 5 pounds of rosin to 1 gallon of alcohol. Denatured alcohol and ordinary rosin are satisfactory. The terne plate bottoms should be bright and clean before dipping in the flux. The brass or copper tops should be cleaned by dipping in a bright dip of sulphuric and nitric acid, well washed in cold and then hot water and finally dipped in the flux. The parts can then be soldered at your convenience as the flux prevents tarnishing and consequent poor soldering.

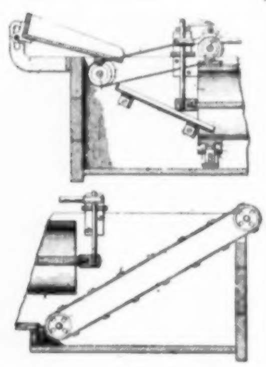
The method of immersing in molten solder with the copper tops if the solder is not allowed to get too hot, will be satisfactory. The solder will gradually take up copper, however, and become sluggish and give a lumpy coating. It will then have to be discarded. With the brass tops the solder soon becomes contaminated with zinc and unfit for use.—J. L. J. Problem 2,410.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,206,122. November 28, 1916. **Electro-Plating Machine.** Edward J. Miller, of Jennings, Mo., assignor to St. Louis Screw Company, of St. Louis, Mo.

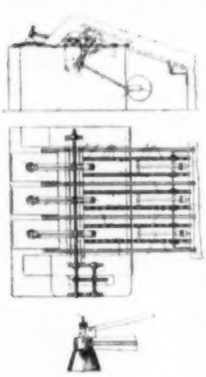
This invention relates to an electro-plating machine, and it has for its object to provide an improved device of this character, as shown in the cut, and constructed in such manner that the work will be automatically and positively turned during its passage through the plating solution.



The inventor is aware of the fact that it has heretofore been proposed to turn the work during the time of plating, but in all of the machines with which he is familiar the methods employed to secure this result are uncertain, particularly on small flat work such as washers or the like.

A further object of the invention is to provide for such an adjustment of the machine during the passage of the work therethrough that the time required for the articles to pass through the plating solution may be varied at will.

1,207,622. December 5, 1916. **Method of Manipulating Metal Articles.** Richard Beaumont Thomas, of London, England, and Hubert Spence Thomas, of Llandaff, and William Robert Davies, of Whitchurch, Wales.



This invention is a division of that disclosed in the application filed June 20, 1914, Serial number 846,305, and is an improved method of manipulating metallic plates, sheets, bars and the like, primarily to effect their withdrawal one by one from a stack or pile for such purposes as turning, examining, assorting and feeding them.

The improved method comprises the elimination or partial elimination of suction between the stacked articles, by separating or tending to separate them through the action of a blast against the edge or edges of the stack or the interposition of a material, such as sand, between the articles, and picking them up singly by suction through appliances adapted for handling the plates. The accompanying drawing illustrating the invention represents in side elevation on appliance or machine for feeding metallic plates or sheets to tinning machines.

1,208,507. December 12, 1916. **Preparation for Silvering or Gilding Metal Articles.** Agnes Dalby, London, England.

This invention relates to the plating or coating of metals the chief object being to provide a new or improved preparation in paste or liquid form for applying to metals such as iron, steel, brass, copper and aluminum for the purpose of silver-plating or gilding such metals in a much simpler manner and at much less cost than by electro-plating or electro-gilding.

For silver-plating the following formula has been found to give satisfactory results as a liquid preparation:

Potassium iodid	in equal parts.
Hydropotassium tartrate (cream of tartar)	
Potassium cyanid	
Double cyanid of potassium and silver ($KAg(CN)_2$)	

Distilled water, one pint to 8 ounces of a mixture of the above substances.

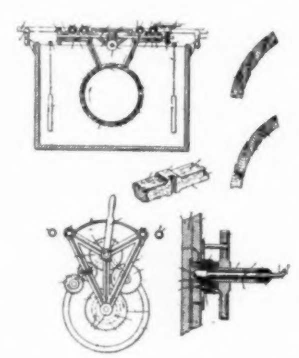
For gilding the following formula has been found to give satisfactory results as a liquid preparation:

Potassium iodid	in equal parts.
Hydropotassium tartrate (cream of tartar)	
Potassium cyanid	
Chlorid of gold	

Distilled water, one pint to 8 ounces of a mixture of the above substances.

1,207,283. December 5, 1916. **Cleaning, Plating, Drying and Burnishing Machine.** W. L. Enghauser, Winslow Park, Ohio.

This invention relates to improvements in a combined mechanical cleaning, plating, drying and burnishing machine.

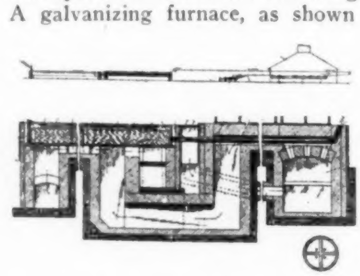


An object of the invention is to produce a single machine, as shown in the cut, for use in all of the operations above mentioned, in which it is unnecessary to remove the work from the machine in carrying it through the successive operations.

A further object is to produce a machine of the class described, which may be carried readily from plate to place and supported on tanks, frame work and other suitable supports used in the various operations above mentioned. A further object is to produce a machine of the character described, having a receptacle which may be moved to a position in which its interior is rendered accessible for the placing therein of articles to be cleaned, plated, dried or burnished, and which may be moved to a position for emptying the contents thereof without having to reach into the receptacle in order to remove the articles located therein.

1,208,185. December 12, 1916. **Furnace for Galvanizing Wire.** Guy L. Meaker, Joliet, Ill.

This patent includes the following claims:



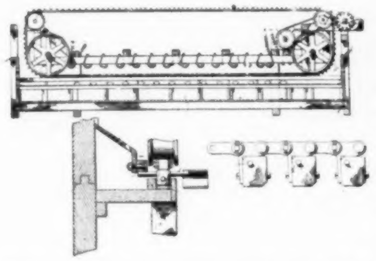
A galvanizing furnace, as shown in cut, comprising a tank, a conduit communicating with the same at the lower portion thereof, and extending to a higher level than the point of its communication, a bath of heavier non-adherent material occupying the lower portion of said tank and conduit, and adapted to support a bath of coating metal supernatant upon the aforesaid bath and means for heating the tank and conduit.

A galvanizing furnace comprising a tank, a conduit communicating with the lower portion thereof at one end, and extending at its other end to a point above the point of its communication with said tank and guides in the upper portion of the tank arranged to direct the wire in a substantially horizontal path through the tank.

A furnace for galvanizing wire comprising a galvanizing tank, a conduit communicating therewith, a heating chmaber surrounding the conduit, a firebox communicating with said heating chamber at one end, a flue communicating with the heating chamber at its other end and extending beneath the galvanizing tank and a supple-mental firebox connected to said flue.

1,208,584. December 12, 1916 **Electro-galvanizing Apparatus.** Alexander Laughlin, Jr., Sewickley, Pa.

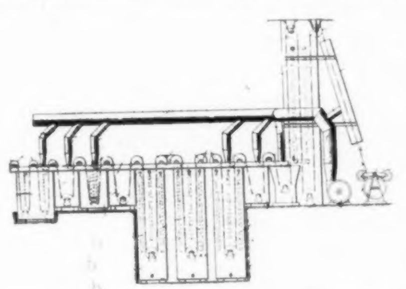
In coating tubes by the electro-galvanizing process, difficulty has heretofore been caused by the lack of uniformity in the coating, those portions of each tube in contact with the fixed conductors or other supports receiving ocnsiderably less coating than the remaining portions.



The primary object of the invention is to provide improved means, as shown in cut, whereby tubes will be uniformly coated over their entire external surfaces while being moved through an electro-plating solution.

1,210,663. January 2, 1917. **Electro-Plating and Lacquering Apparatus.** J. J. Mace and J. R. Muir, of New York, N. Y.

This invention relates to an apparatus for electro-plating or galvanizing wire cloth and lacquering the same, and its objects are to provide a more reliable and flexible means for electrically depositing metals on wire cloth.

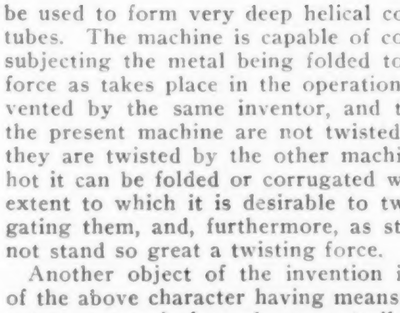


To that end there is provided an apparatus shown in cut, which comprises a plurality of electric generating units each complete in itself, the units being arranged so that they may be run separately or simultaneously to supply electric current to the anodes in the galvanizing baths of the apparatus.

The apparatus also includes means for cleaning the material before it enters the galvanizing tanks and means for lacquering the material after it leaves the galvanizing tanks, so that the material is galvanized and lacquered in one machine and comes out as a finished product.

1,210,895. January 2, 1917. **Apparatus for and Method of Corrugating Metal Tubes.** Louis H. Brinkman, of Glen Ridge, N. J., assignor, by mesne assignments, to Baltimore Tube Company, Incorporated, a corporation of Virginia.

This invention relates to apparatus for and method of corrugating metal tubes. The invention is especially useful for helically corrugating hot metal tubes.

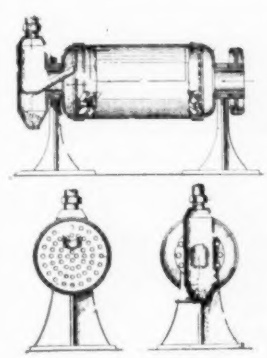


One of the objects of this invention is to provide a durable and efficient machine, as shown in cut, that can be used to form very deep helical corrugations in hot metal tubes. The machine is capable of corrugating tubes without subjecting the metal being folded to such a severe twisting force as takes place in the operation of another machine invented by the same inventor, and the tubes corrugated by the present machine are not twisted to the extent to which they are twisted by the other machine. When the metal is hot it can be folded or corrugated without twisting it to the extent to which it is desirable to twist cold tubes in corrugating them, and, furthermore, as stated, the hot metal will not stand so great a twisting force.

Another object of the invention is to provide a machine of the above character having means which will continuously act to successively and momentarily grip the tube along a helical line at a progressively shifting short portion thereof, and release it,

1,211,111. January 2, 1917. **Cleaner for Tumblers for Metal Castings, Buttons and Other Articles.** M. A. Dunn, of Poughkeepsie, N. Y.

Among the principal objects which the present invention has in view are: to prevent accumulation of deposit of scale, grit or other debris, in the separating chambers provided in tumblers of conventional form; to separate dust or light pulverulent matter from the deposit mentioned; to avoid the necessity inherent in tumblers of conventional construction for discontinuing the service thereof during periods when the debris has accumulated in the separation chamber; and to maintain at all times a free circulation of air through the tumbler.



As shown in the drawings, a tumbler of conventional form is provided with a cylindrical body. The body has fitted thereto and at both ends thereof screens. As shown in the drawing, the screens are provided with perforations, through which small bits of scale, grit or dust are carried from the portion of the body where usually castings are bolted or held.

1,211,218. January 2, 1917. **Process for Plating Metals.** Clark W. Parker, of Detroit, Mich., assignor to Parker Rustproof Company of America, of Detroit, Mich., a corporation of Michigan.

This invention relates to the electro-plating of articles of iron and steel, and its object is to reduce the number of operations and to cheapen the cost of such work.

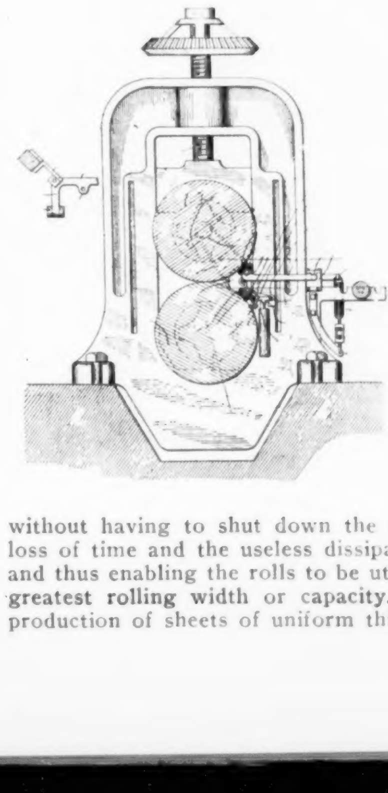
This invention consists in first treating the finished surfaces of the articles of iron and steel by immersing them in a hot solution of phosphoric acid, then placing the articles thus treated in an ordinary electro-plating bath, and finally buffing the articles if a polish is desired.

It also consists in adding manganese oxid to the solution of phosphoric acid in order to intensify the action of the acid.

It further consists in scratch-brushing or buffing the surfaces after the acid treatment in order to obtain a fine smooth surface on which to deposit the nickel or other coating metal.

1,212,131. January 9, 1917. **Means for Grinding and Polishing Rolling Mill Rolls.** A. P. Coate, Middletown, Ohio.

This invention relates to new and useful improvements in means for grinding and polishing the rolls, such as are used in rolling mills.



As is well known, the rolls employed in rolling mills must be maintained at a high temperature in order to insure the working of the rolls to the greatest rolling width. Also, such rolls are subjected to severe usage, which results in roughening the surface of the rolls and causes pitting.

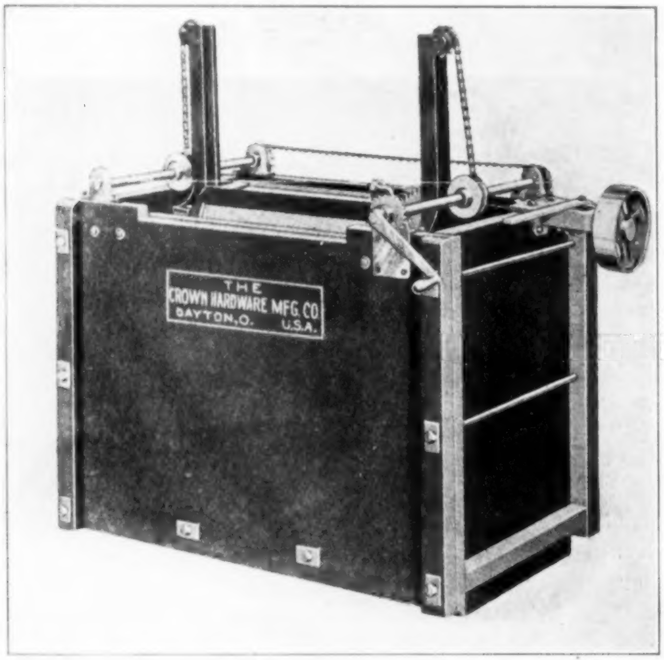
The object of this invention is, therefore, to provide means, as shown in cut, for grinding and polishing the rolls of sheet rolling mills and for maintaining the rolling faces or surfaces thereof parallel without having to shut down the mill with the consequent loss of time and the useless dissipation of heat of the rolls, and thus enabling the rolls to be utilized at all times to their greatest rolling width or capacity. And also insuring the production of sheets of uniform thickness.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

NEW PLATING BARREL

The plating barrel shown in the cut has recently been placed upon the market by the Crown Hardware Manufacturing Company, Dayton, Ohio. This company states by F. H. Hartzell, secretary and treasurer, that they have had entirely satisfactory results in the use of this barrel in their own factory, and that



THE CROWN HARDWARE MANUFACTURING COMPANY'S NEW PLATING BARREL.

they have a number of machines that have been running for the last sixteen or eighteen months without any mechanical attention at all.

The Crown plating barrel has a number of features by virtue of which the manufacturers claim it to be the most practical mechanical plating barrel yet introduced. This barrel is used for nickel, copper and brass plating and galvanizing.

A few of the good facts about this barrel mentioned by the makers include the following: The cylinder is made of mahogany and therefore is guaranteed not to swell or warp out of shape. Inside contact strips run from the center bearing along each rib of the cylinder, thus insuring continuous contact. There are splash boards arranged for keeping solution from the anode rods. The contacts to the cylinder are always clean, running in bronze bearings.

The makers of this barrel guarantee that it will plate more parts in ten hours than any other barrel. Also that it will plate pieces that cannot be plated in other barrels and that the machine can use a lower voltage owing to the peculiar construction of the contacts. Further particulars may be had upon request.

LITHOGEN

Lithogen is stated by the manufacturers, the American Chemical Paint Company, Philadelphia, Pa., to be a primer which is guaranteed to prevent paint from peeling off new galvanized iron surfaces. Lithogen is a clear, watery-like solution of such chemical properties that when it is applied to the galvanized iron it turns the outer surface into a stony substance which cannot be washed or chipped off, and to which the paint strongly attaches itself. The coating of Lithogen slightly absorbs the first coat of paint which, on drying, becomes inseparable from it.

Lithogen contains no oils, varnishes, pigments or volatile solvents, being a thin, non-volatile liquid and it is claimed that its covering properties greatly exceed that of a paint or varnish. When applied with a brush one gallon will cover from 1,500 to 2,000 square feet, this makes the cost per square foot for material very small.

The manufacturers state that "paint applied after the surface has been treated with Lithogen never peals off; its life, however, naturally depends on the quality of the paint, and after a time the surface will have to be repainted. The surface, however, produced by the Lithogen is everlasting and it does not have to be retreated before repainting—the paint-shedding properties of the galvanizeed iron are permanently destroyed by one application of the Lithogen. The stony surface produced by Lithogen is not affected by baking temperatures. It is therefore possible, by the aid of Lithogen, to use a baking enamel on zinc and galvanized iron."

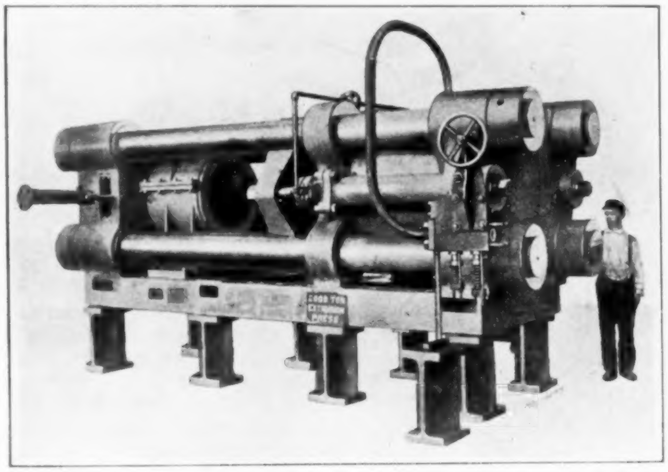
An instructive folder has been prepared by the American Chemical Paint Company, which gives full directions for the use of Lithogen, and this folder may be had by applying to the above company.

HYDRAULIC EXTRUSION PRESS

Similar in construction to the hydraulic extrusion press manufactured by the Krupp company at Essen, Germany, the extruding capacity of the Southwark press, here shown, is from 35 to 40—7" x 30"—billets per hour. The working pressure for this machine is 5,000 pounds per square inch.

In the development of this press both the design and method of operation have been perfected to the highest degree, thereby insuring maximum production at minimum cost for power and tool upkeep. Southwark presses are now producing between 50,000 and 80,000 pounds of extruded rods per day and are built for 1,000-2,000 tons capacity.

The Southwark method does away with the annealing process as the extrusion is completed in a single operation.



THE SOUTHWARK EXTRUSION PRESS.

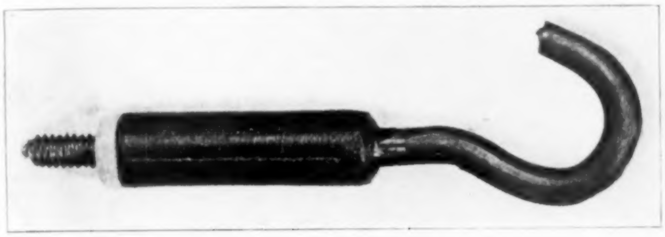
Pickling is likewise unnecessary except in cases when a special finish is required.

The pressure chamber is made from a special alloy steel of high tensile strength. A jacket connecting with the fireplace beneath encases the chamber, and through this jacket the heated gases pass around the chamber keeping it heated to a temperature of 600° Fahr. to prevent chilling.

The metal blocks are heated from 1,650° to 1,800° Fahr. before working, and if suddenly cooled the surface of the metal loses plasticity and makes satisfactory work impossible, besides delaying the extrusion process. The press is made by the Southwark Foundry and Machine Company, Philadelphia, Pa.

INSUL-BAKE PLATING HOOK

The Niagara Insul-Bake Specialty Company, Niagara Falls, N. Y., have recently produced a hook, shown in the cut, which



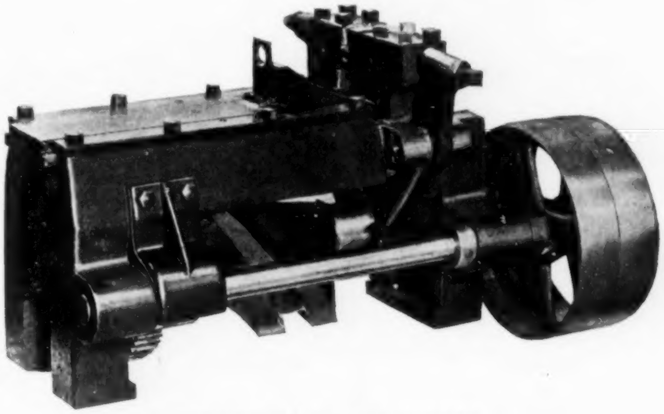
THE INSUL-BAKE HOOK.

they call the "Every Ready Anode Hook." This book is made of copper wire and has been coated on the portion that is immersed in a plating solution with Bakelite. There is supplied with each hook a small felt washer, which can be seen in the cut, which allows the hook to be screwed down firmly and no solution can then penetrate to the copper hook and eat it off.

The hook is the invention of R. C. Bickerstaff, superintendent of the Niagara Insul-Bake Specialty Company, and retails for twenty-five cents. The economical features of this hook are self-evident as it enables the user to get the fullest efficiency of his anode by allowing for complete immersion.

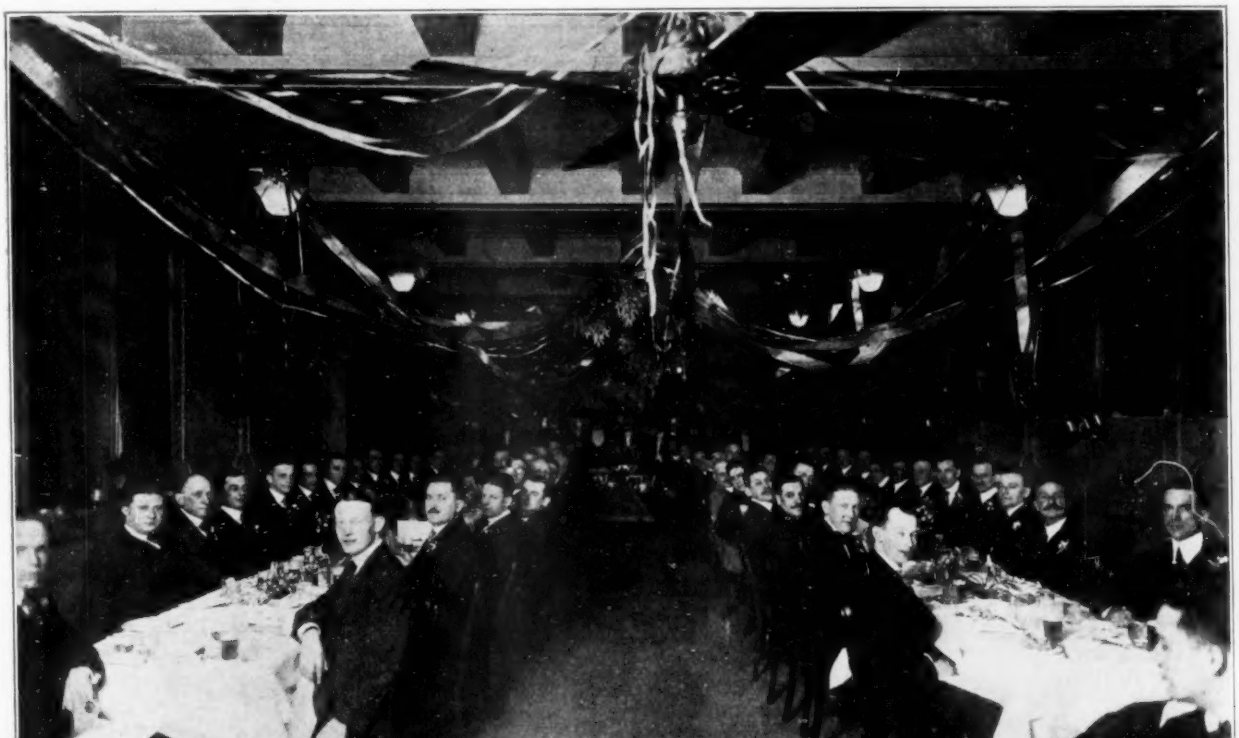
CORE-WIRE PULLER

The machine shown in the cut is a recent production of the Turner Machine Company, Philadelphia, Pa., manufacturers of molding machines and other foundry apparatus. Realizing sometime ago the need of a method of removing the core wires from castings, the Turner company set to and devised the machine



TURNER CORE WIRE PULLER.

here shown. The construction of the machine is so simple and its operation is so obvious that practically no description of it is necessary. All that is needed to be said is that the machine does the work to the satisfaction of a number of users. Further particulars regarding the machine may be had by corresponding with the Turner Machine Company, 3632 North Lawrence street, Philadelphia, Pa.



DINNER TENDERED BY THE STAMFORD ROLLING MILLS TO THE HEADS OF DEPARTMENTS AT STAMFORD, CONN. THE CHIEF FEATURE OF THE DINNER WAS THE LAVISH USE OF THOSE PRECIOUS METALS, COPPER AND BRASS

FELT

By Fritz Dolge, President The Dolge Felt Company, Oxford, Mass.

Felt is undoubtedly the least known of the textiles, notwithstanding the fact that it is in all probability the oldest fabric known to mankind. Legend has it that the monk of olden days, clad in skins and wooden sandals, implored the Lord to grant him relief from his sore and aching feet; whereupon he was allowed to pluck the wool of the sheep, placing the same between his feet and the surface of the wooden sandal, and through the continued action of the pressue of the foot against the wool it felted and became a fabric. Our museums, both here and abroad, teach us that in the earliest days armor, both helments and shields, were lined with felt, so that the fact is established that in a crude manner felt has been known as far as the history of man has been traced through his works.

Felt is applied in more ways to mechanical appliances than any other textile, owing to the fact that it has the following very necessary qualifications: Felt cuts with a clean edge without ravel, being a homogeneous substance. It can be made in thicknesses varying from 1/64 to 3 inches thick commercially. It can be made as soft as a bat of wool and as hard as wood. Felt is a non-conductor, it is an absorbent, it makes an ideal filter, because it does not deteriorate with age; it makes an ideal buffer or shock absorber. Indeed, our highest type of grinding machines have their pedestal resting on a base piece of felt to very greatly lessen, if not entirely eliminate, the transmission of vibration from outside sources to the machine, making extremely accurate work possible.

Felt can be cut in any shape for gaskets, washers, filters, oil rings, buffers, silencing pads, wicks and a thousand other mechanical uses that are kindred to these. Felt can also be made equally strong in the various directions of strain, in that respect being totally unlike woven fabrics. Felt has successfully and permanently replaced fibrous packings of various natures, leather, rubber and other substances which deteriorate through age, oxidation or chemical reaction. It will stand fairly high degrees of heat without injury, the degree depending upon whether the felt is being used dry or with oil, etc. Automobile engineers were quick to appreciate the virtue of felt, and in turn the electric appliance manufacturers have generally adopted its use. As a silencing and deadening material it is most generally known as the covering of the base of all telephone instruments, but lamps and other metallic objects will be found shod or clothed, so to speak, with felt, with this end in view. Every incandescent lamp has a little disc of felt in the seal.

Felt is made of wool entirely, or wool mixed with other fibers, such as cotton, and a great variety of textures, tensile strengths and resilient qualities are possible, according to the construction of the fabric to suit the particular need. While undoubtedly most felt for mechanical purposes is used in gray, it can be had in white, black and colors. Gray, however, being a natural or undyed color and therefore free from chemicals of every nature, has been accepted as the most satisfactory for general mechanical purposes.

The uses to which felt is put are a thousand fold, but because the quantities in the various fields are somewhat limited the textile is not known as well as it should be among designers, engineers and manufacturers. It often happens also that a piece of felt known to a layman is not adaptable for the purpose he has in mind, and failing to make the necessary inquiry, he does not discover that it can be had in the particular form and possessing the characteristics which he desires for his purpose.

New uses for felt have sprung up with our ever increasing industrial activity. Its growth, however, has not been commensurate with its attributes because it has not been practical to advertise in any given field of industry in a sufficiently broad manner to warrant the expenditure if fairly sizable and prompt returns are to be considered. In some branches of trade, of course, a sufficient demand has existed to warrant advertising, especially in such fields as the piano, organ and phonograph trade, where felts are used for hammers, linings and turntable covers, respectively; also in the harness and saddlery field, where they are used for pads and blankets, but generally speaking, the divergent uses to which felt is being put have made it difficult to get the subject in its entirety before those who might be most interested in and benefited by its use and application. Until the cost of leather advanced this material was commonly used for the box toe or under cap of the shoe. In recent years, however, felt has been taken, impregnated with a substance having a high temperature melting point, and successfully molded into toe caps that are in the many ways superior to the leather formerly used.

To demonstrate the wide range of uses to which the material is put it might be pointed out that the jeweler uses felt for polishing, both in the shape of buffers and wheels; the glass trade use it for polishing plate glass; the hat manufacturer makes it into women's hats; felt slippers are too well known to need more than mention; the coat front in a man's coat is lined with what is known as a tailor trimming felt; the piano hammer that strikes the strings in a piano is covered with felt; the automobile you ride in has felt washers and gaskets, and so on through a practically endless list.

The uses, broadly speaking, to which felt has been put have been classified, but owing to the fact that the first purchaser is not necessarily the user, it has been difficult in years gone by to trace the ultimate uses to which felt has been put. Latterly, however, where fairly rigid purchasing methods have prevailed, a specialized service has been sought by the users, with a result that there has been a more consistent contact with the first hand or manufacturer.

Padding for chairs, baseball mitts and a thousand other purposes, such as manicure buffers for example, have given a further field for development. In our school days we remember the felt eraser with which we cleaned the blackboard. Weather stripping to keep the cold out of our door and window casings in houses as well as trains and automobiles, has made a further demand for felt, and yet with an indication of the large field that I have given it is still true that the felt industry is the stepchild and smallest in point of pounds produced of all the textile trades.

The industry has attracted relatively few men of specialized training, because educational facilities in this particular line of work have been lacking in this country, as compared with Europe, where the felt factories outnumber ours in the ratio of approximately 12 or 15 to 1.

Within the past dozen years the special cut trade, such as the cutting of washers, gaskets, castors, truck wheel tires, cash carrier buffers, inking pads, strips and formed pieces of various kinds has led to the establishment of concerns who make a specialty of this line of work. This has greatly benefitted the industry as a whole, because great waste has been eliminated and the use of all of the former wastes has been fairly assured.

Metal goods manufacturers needing material for silencing, moisture retaining, sound deadening, dust proofing, shock absorbing, polishing, buffing or kindred purposes would do well to make inquiries of a felt manufacturer before deciding to use such materials as cotton wicking, leather, rubber, asbestos or papier-mache. The non-conducting qualities of felt have always been an important determining factor in its use in the metal industry. Its use in motors as a ring oil carrier is the highest tribute that could be paid its moisture retaining and distributing qualities. Of course, all inking devices have always used felt as their base where type were applied on other than a rotary principle. Silencing pads under typewriters made of felt to lessen and deaden the sound are well known and point to other uses in the same direction.

If the message can be carried to our designers and engineers generally that felt can be cut in any direction or any shape and form, giving equal strength in all directions, without a fraying of edge, that it can be had in all consistencies or textures reasonably required, that it can be had in thicknesses of great range, that it can be impregnated to meet certain requirements, that it is a non-conductor, an absorbent, and what is perhaps most important, that it is relatively low in cost when all of the qualities are considered, it will follow that its uses will be very greatly increased and with gratifying results.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN ELECTRO-PLATERS SOCIETY

Chicago Branch.—John P. Mantz, president; Oscar E. Servis, secretary, 3020 George street, Chicago, Ill.

The fifth annual banquet of the Chicago Branch, a photograph of which we show, was held at the Grand Pacific Hotel, January 13, and scored another success for this progressive branch. The banquet committees were as follows: Committee of Arrangement, E. Lamoureux, O. E. Servis, F. J. Liscomb, H. E. Willmore, C. E. Thornton, J. C. Tobinski, C. A. Barnes, H. G. Stephen, H. Binder and H. A. Gilbertson, and the Reception Committee, J. H. Hansjosten, J. H. Hall, N. P. Hunter, W. Schapper, S. E. Huenerfauth, H. H. Posbeck, F. P. Davis, C. B. Wrout, E. L'Hommedieu and W. J. Terpenny. The program, which included a number of technical features, consisted of an introductory address by John P. Manz, president of the Chicago Branch; "Research in Metal Cleaning," by C. B. Willmore; "The Work of the State of Illinois Department of Factory Inspection," by Oscar F. Nelson, chief factory inspector; "Some Simple Methods of Analyzing Solutions," by F. J. Liscomb; and "Law Governing the Principles of Electro-Deposition," by Dr. Oliver P. Watts, of the University of Wisconsin.

Following the completion of the educational program, the center of the banquet room was cleared, and then came what may be properly termed the fitting climax of the evening, which was that of the program of dances, indulged in by all the guests from 11 o'clock until 1 a. m. If there had been anything lacking in enthusiasm at any time during the evening it is only necessary to mention this part of the program as the most thoroughly enjoyed from a pleasure standpoint.

THE FIFTH ANNUAL BANQUET CHICAGO BRANCH AMERICAN E LECTRO-PLATERS SOCIETY.

BANQUET NOTES.

We are aware that our president, John P. Mantz, is a splendid dancer, but for some unaccountable reason he did not seem to be able to get started.

R. G. Neal, secretary, O. E. Servis, was everywhere, and had the time of his young life.

Our vice-president, H. A. Gilbertson, was very much in evidence and is "some" ladies' man.

One party who perhaps had as good a time as anyone present, was J. H. Moore. It does not seem to us that he missed a single dance, which is the proper spirit.

The "deacon," H. E. Starrett, fairly radiated friendship and welcome to all those whom he met, but he did not display his ability as a dancer, much to our regret because we know he is a good one.

Our friend, Art Wicks, came down from Woodstock, Illinois. Art, as a rule, never fails.

Our esteemed sergeant-at-arms, James Emmet, was there with bells on, and did his share to help entertain the ladies. James is one of our ultra-dependables, and burns up the rails from Laporte, Ind., to Chicago, regularly once a month.

"Dad" and his smile assisted materially in getting the ladies acquainted, but some disappointment was felt among his friends who know him best at his failure to display his agility as a dancer.

surprised us and assisted quite materially in spreading the good cheer around.

Henry Magnus might be termeed the "Silent Smith" of the branch, but his good nature radiates, in spite of his habit of being reticent.

Frank P. Davis gave us a helping hand and never was hard to locate. We are always glad to have Frank with us for that reason, as well as his good fellowship.

In the summer time S. E. Hennerfauth necessarily must mow the lawn on meeting nights, that is his excuse for getting away early. This time we caught him trying to form a colony to help him shovel snow from the lawn, and yet the Mrs. was with him. Just what his fears were we don't know. Please explain yourself, Sam.

Some people go through life with handicaps of various kinds, and our good friend, N. P. Hunter, is handicapped by being a double of President Wilson, and no doubt feels that he must deport himself accordingly. This worked a hardship upon the party and himself, owing to his seclusion around the cloak room.

HELD AT GRAND PACIFIC HOTEL, CHICAGO, ILL., JANUARY 13, 1917. (NOTE THE PRESENCE OF THE FAIR SEX.)

Fran Terrio never makes much noise, but that boy surely is some dancer.

Walter Schapper never fails to be present at our annual affairs. We don't know whether it was his modesty or fear of the ladies that prevented him from getting out on the floor.

Colonel Hansjosten was implored to demonstrate the "fox trot" in German, but evaded the appeals of his friends in his usual diplomatic manner.

Our friend, Roody, and Mr. Massaut, of the Sutart Warner, We wonder if he could tell us which one of the girls got away with the roses.

St. Louis Branch—F. C. Rushton, 4405 Blair Avenue, St. Louis, Mo., secretary.

The regular monthly meeting was held at the St. Louis Public Library, Saturday evening, January 20, during which the banquet and 1917 convention were discussed. After the regular business session an interesting paper from Joseph

Walters, of Richmond, Va., on "Nickel Plating Solutions" was read, and which proved so interesting that the discussion of same was postponed until the next meeting. H. Duebelbeis has promised to offer something on zinc cyanide solutions at the next meeting.

The St. Louis Branch held a very successful banquet on January 27, which went off with a vim from start to finish due to the energetic efforts of E. J. Musick, chairman of the arrangement committee. After the banquet several well known platers were introduced who gave some interesting talks on various subjects relating to the plating industry.

Indianapolis Branch.—B. D. Aufderheid, president, and Louis Mertz, 1725 Union street, Indianapolis, Ind., secretary.

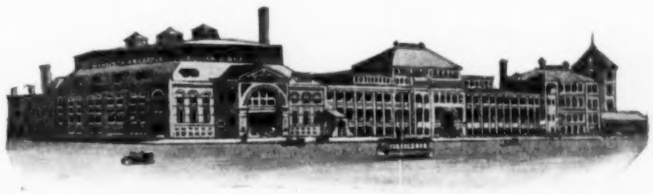
The regular meeting was held January 13 at which meeting Richard Sliter and Charles Werit, of the Cleveland Branch, were visitors. Communications were read and placed on file. An interesting discussion was had on the spotting-out question; Mr. Sliter making some remarks regarding his experiences with spotting-out and the method he used to overcome them. Mr. Aufderheid, of the Indianapolis Plating Company, having had considerable trouble with copper-plated malleable iron hammers, had several samples of spotting-out. In giving an outline of his experiences he was convinced that spotting-out troubles were not confined to work plated in cyanide solutions, as he exhibited samples that had been struck with nickel and then plated in a duplex copper solution and which spotted-out just the same. Under the miscroscope the small pores could be seen to contain crystals, which were supposed to be produced by the cleaner used, as they appeared in the pores of both the acid copper and cyanide plated hammers.

New York Branch.—H. H. Reama, president; William Fischer, secretary, 300 St. Ann's avenue, New York.

William J. Schneider, chairman of the banquet committee for the annual banquet of the New York Branch, which will be held February 17, at the Broadway Central Hotel, New York, reports that he has secured Dr. Charles Baskerville, of City College, New York; Dr. C. W. Bennett of Cornell University; Dr. Hiram S. Lukens of the University of Pennsylvania, and George B. Hogaboom as speakers of the evening. A committee will be in the Hotel Parlors all day on February 17 to take care of members and their friends. Any samples that are to be exhibited can be sent to the American Electro-platers' Society, care of Broadway Central Hotel, and will be taken care of by the management there until such time as the exhibit is to be set up. Tickets can be obtained from any of the members, or William Fischer, secretary, 300 St. Ann's Avenue, New York City.

AMERICAN INSTITUTE OF METALS

The joint convention of the American Institute of Metals and the American Foundrymen's Association will be held in Boston, Mass., the week of September 25, 1917, and in connection with this convention the annual exhibition of foundry supplies and apparatus will be held in Mechanics Hall under the auspices of the two societies. C. E. Hoyt, Lewis Institute Building, Chicago, Ill., is exhibition manager and will be glad to hear from any concerns wishing to exhibit.



MECHANICS BUILDING IN BOSTON, MASS., WHERE THE 1917 EXHIBITION OF FOUNDRY SUPPLIES WILL BE HELD.

William A. Cowan, chairman of Committee on Papers, has issued the following:

"To the Members—The last convention of the Institute of Metals was, we believe, the most successful of all, both in the number in attendance and in the interest shown in the papers presented.

"You, as a member of the institute, are doubtless greatly interested in continuing this progress in order to increase the value of our society to ourselves and to the public. The way to accomplish this is to boost our next meeting, which will be held in Boston during the week of September 24 in conjunction with the American Foundrymen's Association.

"You can be of immediate practical assistance to our committee, either by yourself offering a paper or by suggesting subjects which you think would be of most interest and the persons best fitted to write on them. Will you do this?

"We desire especially to obtain papers on practical subjects, and in order to add more interest to the printed papers we would like to arrange for the coming meeting to have experiments and demonstrations or other illustrations showing new processes, etc.

"If no topic of particular interest occurs to you at the moment, will you not think over the matter, and some problem connected with your work or in your shop may come to your mind. We trust that you will give a little time to the consideration of this matter and particularly request that you reply in any case within one week."

PERSONALS

ITEMS OF INDIVIDUAL INTEREST

Paul Hultich has taken charge of the brass foundry of the Nelson Valve Company, Chestnuthill, Pa.

Carl J. Carlson has recently become connected as foreman plater with the Boyle Manufacturing Company, Fifty-first street and Santa Fe avenue, Los Angeles, Cal.

C. E. Seely, formerly connected with the Dayton Engineering Laboratories Company, Dayton, Ohio, has now become connected with the Parker Rust-Proof Company, Detroit, Mich.

George Giffault, widely known in the metal trade through his long connection with Fitz, Dana & Brown, Boston, has become connected with the North American Copper Company, 52 Vanderbilt avenue, New York.

A. P. Rudkin, formerly connected with the Stamford Rolling Mills Company, Stamford, Conn., has become connected with the Dominion Copper Products Company, Ltd., Lachine, Quebec, Canada, as an accountant.

George C. Holder, recently research chemist for the American Optical Company, Southbridge, Mass., is now chemist and metallurgist with the Wheeler Condenser and Engineering Company, Carteret, N. J., who have recently started in the manufacture of condenser tubing.

Harris Whittemore, of Naugatuck, Conn., has been elected to fill the vacancy in the American Brass Company, Waterbury, Conn., caused by the death of A. A. Cowles, a director and vice-president of the company, and Royall Victor, of the law firm of Sullivan and Cromwell, New York, has been elected a director to fill the vacancy caused by the death of John Sinclair.

THEORY AND PRACTICE AS THEY MAY BE APPLIED TO ELECTRO-PLATING

Some Thoughts as to the Value of a Knowledge of Chemistry to the Electro-plater.

By H. B. North, D. Sc., Associate Professor of Chemistry, Rutgers College, New Brunswick, N. J.

[An address delivered before the Newark, N. J., branch of the American Electro-Platers Society at its December, 1916, meeting. The night on which the meeting was held was so stormy that only a few members and their friends were present. Dr. North's address has so much in it of value to the electro-plater that we believe we are doing those who were unable to hear it a service by printing it in full. It is not often that a college professor in addressing an audience that is made up of mostly practical men can refrain from introducing complicated chemical formula, but this is what Dr. North has done in a refreshing manner.—Ed.]

INTRODUCTION

Far be it from my usual custom to commence a lecture with an apology, no matter how formal or informal the lecture may be, but in the present instance I greatly feel the need of deviating from the beaten path. When I received your president's kind invitation to address you this evening, suggesting as a subject: "Why an electro-plater should have a knowledge of chemistry," I felt greatly tempted to reply with the suggestion that I could give a much more intelligible talk if the subject were changed to: "Why a teacher of chemistry should possess a knowledge of electro-plating." The latter subject would have required but a few words inasmuch as anyone who has ever taught chemistry in a college or who has studied the subject in such an institution, knows full well that a teacher of chemistry, in order to be most successful, should not only possess some knowledge of the science but, to a certain extent at least, should also be able to perform the duties of the carpenter, plumber, electrician, tinsmith, machinist, electro-plater, painter and janitor.

I do not pose before you tonight as an expert on electro-plating for it is undoubtedly true that the majority of you have forgotten more about the subject than I ever knew. It is quite true that during my undergraduate and graduate training, I pursued courses of study in both theoretical and applied electro-chemistry, but this was merely as a matter of rounding out my chemical education. I know just enough about electro-plating to manage to keep my bunsen burners, electrode stands, and other metallic pieces of lecture apparatus nicely plated, and I greatly regret that I am not sufficiently well informed on the subject of applied electro-chemistry to be able to give you an interesting and instructive lecture on some phase of this subject.

I come before you this evening knowing little or nothing of the scientific training of my audience, but simply that you are foreman electro-platers; I come with no intention of attempting to prove to you that a knowledge of chemistry is indispensable to your success as electro-platers, for I know full well that many engaged in this occupation have never studied chemistry; I come with no intention of inducing you to give up your profitable positions in order to enter some school of chemistry; I come simply to present to you a few random thoughts on the subject of theory and practice and to suggest a few ways in which a knowledge of chemistry might possibly be of use to you in your profession.

THEORY WITHOUT PRACTICE.

Practice without theory is bad; theory entirely without practice is to my mind considerably worse. I well remember a conversation I once had with a chance acquaintance with whom I was taking a canoeing trip in the northern woods of Wisconsin. My friend was a rough southwesterner who had never had on a white shirt and who abhorred all the little conventions of polite society. But he had a good heart and a better head. He was greatly interested in chemistry, geology and literature, and had spent the summer studying at the University of Wisconsin. Well, we were talking about distilled water. Being a graduate of the school of pharmacy of the university and also a newly appointed assistant in chemistry, it is probably not strange that I considered myself somewhat an authority on the subject. I well remembered a proof which a professor one day gave us to the effect that distilled water has a poisonous action on the stomach. So I carefully repeated this proof to my friend to back up my statement that distilled water is poisonous. After I had finished, my friend smoked his pipe quietly and thoughtfully for some five or six minutes, and then completely floored me by saying that he wished he had known about distilled water being a poison; that during the ten years he had worked in a mining camp down in Arizona, the only drinking water available was distilled water. He was a most healthy-looking individual. Theoretically my proof appeared flawless; practically it was wrong. I now know that it was wrong because many people use distilled water as a drinking water without harmful results. In fact I know that there are a number of companies who bottle and sell distilled water for table use.

THEORY VS. PRACTICE.

While I was still an undergraduate at the University of Wisconsin, I at one time proposed to a well known cement contractor that he sample every car of cement purchased and send me the samples for physical and chemical tests. He could then buy his cement on specification. His reply was a grin, accompanied by the statement that he didn't give a rap about what the cement tested so long as it worked. In a similar sort of a way, many of you probably care little or nothing about the index of refraction of copper sulphate, nor of its dissociation temperature, specific gravity, solubility at high and low temperatures, hardness, etc., so long as this salt, dissolved in the proper amount of water and mixed with the proper amount of sulphuric acid, yields a plating solution which works well. It is likewise probably that you do not even care to know what is the exact purity of the salt, for the reason that you are well aware of the fact that mere traces of impurities do no harm.

On the whole you are right about the copper sulphate as was the cement contractor about the cement. But I hope to show later that after all it would be somewhat advantageous for an electro-plater to have a knowledge of chemistry; that it would have been better had the cement contractor known something of the value of his cement before actually using it.

SOME EARLY THEORISTS.

But since I can do little more than tell stories this evening, let me give you another. There was once a poor young man named Micheal Farady engaged as a bookbinder's assistant. Sir Humphrey Davy, who was a great scientist at the time, was in the habit of having his books bound at this particular bindery. One day he went to the bindery and registered a profound kick as to the length of time it required to bind his books. Said it took five or six weeks whereas he should have had them back in a week or ten days at most. The bookbinder replied that the reason was that his assistant sneaked the books off down cellar and read them before they were bound. Davy wondered what kind of a boy it was who could enjoy reading such dry stuff, so he asked to see Micheal Farady. And the outcome of it was that Farady was sort of adopted by Davy, and himself grew up to be a great man.

Farady is known to many today as the first applied electro-chemist. One day Farady made a great discovery; he found that if an electric current is passed through a number of cells in series, these cells containing solutions of different metals, the same weight of metal is not deposited in each case but that the equivalent weight is deposited. If the current was allowed to run until one gram of hydrogen was deposited, there would likewise be deposited 108 grams of silver, 31.5 grams of copper, etc. It seemed queer. Now the greatest living chemist at the time was a Swede named Berzelius. He was a great chemist; quite a theoretical man. Well, when he read what Farady said about the weight of different metals being deposited by the same current, he was amazed. He reasoned that it was impossible; that the amount must be in proportion to the atomic weights. And he wrote in one of his publications a statement to the effect that any fool could see that Farady's statement was not true. Furthermore, he was not satisfied to have it printed in the regular sized type, he had it put in extra heavy black-faced type, and there it stands today and for all time as a monument to his foolishness. If he had only stepped into his laboratory and made a few ex-

periments he would have seen the truth of Faraday's statement. Of course he did see it afterwards, but it was then too late to take the heavy-faced type from the publication. Theory alone prompted Berzelius to contradict Faraday's statement; Faraday knew that the statement was true for he had actually proved it in the laboratory and, in fact, he had discovered it from his experiments.

PRACTICE WITHOUT THEORY.

A thorough knowledge of chemistry or more correctly speaking, a thorough knowledge of the theories of chemistry, not infrequently results in the prediction of results or in determining the proper regulation of conditions so that the maximum efficiency of a process is obtained. But this is not always true. Strange as it may seem for one of my profession to make such a statement, I wish to say that the theory of industrial chemical operations usually does not precede the practical attainment but on the contrary quite generally follows it about ten years later. Not long ago a well known chemical engineer made the statement that a lead chamber sulphuric acid plant, constructed and operated according to the best known theory on the subject, would fail to work. Unquestionably this statement is overdrawn, but it is undoubtedly true that a plant so constructed and operated would not yield the most satisfactory results; that the efficiency of the plant would not be high.

Now on the other hand, practice without theory is likewise bad though perhaps not quite so bad. I do not know but that I should refrain from saying that it is bad; it might be better to say that practice without theory is not conducive of the best results. I have just spoken of the lead chamber process for the manufacture of sulphuric acid. It is quite true that this process could be successfully and economically carried on in a mechanical sort of a way by workmen having no chemical training, but on the other hand it cannot be denied that these same workmen, if possessed of a thorough knowledge of chemistry, would undoubtedly be able to obtain results, that is, higher efficiency, and certainly this knowledge would be of almost untold value and service at any time when troubles arose.

I have also referred to the cement contractor. Well, he would not listen to any proposition that I made about testing his cement. He had never had any trouble with it. But about a year after I had proposed this scheme of testing, he ran up against a very bad proposition. A shipment of three carloads of cement proved to be of inferior quality and of course he didn't know it until the cement had been used. Fortunately it was used only for sidewalks, curbing and gutter, hence the failure was not as grave as if it had been employed in the construction of bridges, culverts or large foundations. Anyway, three carloads proved bad. Now if that cement had been sampled and thoroughly tested according to my suggestion, he would undoubtedly have discovered its inferior quality before it was used and he would have saved himself a great deal of trouble. But he did not find out until it had been used and as a result he was compelled to put in a lot of work over again. Yes, and he nearly had a lawsuit on his hands, for of course he refused to pay for the cement. He afterwards acknowledged to me that it probably would be much better to have every shipment sampled, and tested and that all of this trouble could have been averted had he made a practice of doing so.

Pharmacy is frequently learned by actual work in a drug store. This is a good example of practice almost totally without theory. A pharmacist so trained usually is able to get away with the business, but he is in many respects at a disadvantage. He does not appreciate the composition of the substances he handles and he is entirely incapable of knowing whether two substances will mix or are incompatible. He knows little or nothing of the purity of his chemicals and is almost totally unable to intelligibly test them for impurities.

I well remember when, as a young boy, I desired to make some type metal. I experienced no difficulty in securing a sufficient amount of lead from the end of a water pipe, while no one was looking, but I was in trouble when it came to the antimony. I therefore repaired to a drug store and asked for a certain amount of antimony. The clerk consulted the owner of the store, and after a due amount of talking they sold me the required weight of a dark-colored powder. I tried to melt this with the lead but it would not melt; I finally came to the conclusion that something was wrong. I had not studied chemistry so I did not know just what the trouble was. I knew that antimony and lead melted together in the proper proportion gave the alloy known as type metal; I easily recognized lead but I knew nothing about antimony except the spelling of the name. But just the same I knew fully as much about that particular metal as did the druggist. And I never did find out what they had sold me until after I had studied chemistry and pharmacy in the University of Wisconsin. What they had sold me was antimony sulphide; no wonder I could not melt it! But I have long since ceased to hold a grudge against the druggist, the poor fellow did not know any better. He had a practical knowledge of pharmacy which proved entirely adequate for the ordinary run of business but when anything out of the ordinary came up, he was lost, hopelessly lost.

But I have just been speaking of the bad points of theory without practice. This is also true of pharmacy. A thorough training in theoretical pharmacy and pharmaceutical chemistry even in the best of schools is entirely inadequate without practical experience. The State boards of pharmacy of most States fully appreciate this and as a result have made due provision for such cases. After learning the theoretical side, the candidate for licentiate papers usually must spend two years in a store in order to fully learn the practical side of the business. The combination of the two is excellent. A man so equipped can do his work more intelligibly, is better able to judge of the strength and purity of materials, and, if occasion demands, can readily apply tests for impurities or even make quantitative determinations of the active parts or of the impurities.

COLLEGE PROFESSORS AND PRACTICE.

College professors of chemistry are frequently accused of being mere theorists who feel that anything in the line of practical work is beneath them. If there is anyone in my audience who has this opinion of the over-worked, underpaid class of mortals of whom I am a representative, I wish above all to inform him that the accusation is unjust, extremely unjust. At the beginning of this talk I stated that I consider practice without theory as bad but that theory without practice is worse. I mean exactly what I say. It is true that we college teachers of chemistry must and do lay great stress on the theory, for this is the fundamental of the science. But we also devote considerable time and attention to the practical side, that is, to the actual use of the various reactions and laws of chemistry. In the time devoted to the presentation of sulphuric acid, the teacher of general chemistry gives the theory of the formation of the acid but he also takes up the practical side by actually describing the plant in which the acid is made, the lead chambers, Gay-Lussac and Glover towers, the pyrites burners, niter ovens, etc. It is quite true that the latter descriptions are general; it is impossible and unwarranted for the teacher to mention the number of rivets in each plate of the Glover tower; it is unnecessary to go into the thickness of the lead lining of the chambers, and it is likewise ridiculous for him to mention the number and size of the iron bars in the grates of the pyrites burners. But the general outline of the plant and methods of working are profitable subjects upon which the professor lays fully as much stress as upon the chemical equations which represent the reactions taking place. So what is actually taught is after all a mixture of theory and practice.

In lecturing to my students, if I were to state that an electric current passed through a solution of sodium silver, cyanide would cause the silver ions to be deposited on the negative pole, the statement would probably prove of some interest but would not appear to be of any practical value. But if I add that this is the chemistry of silver plating, the student will immediately grasp the fact as one of considerable importance. If I should state that silver salts in general are in some peculiar way affected by light so that they are rendered susceptible of reduction to metallic silver by mild reducing agents, no one would give the thought any serious consideration; but let me mention that the entire art of photography is based upon this peculiar action of light and the student's interest is thoroughly aroused. If I state that molten borax dissolves metallic oxides, the student may consider it as a somewhat peculiar and possibly interesting fact, but the importance of the reaction will be appreciated when I add that in welding iron, the red hot pieces of metal are dipped into borax to dissolve away the film of oxide thus leaving the surfaces to be welded bright and clean. All in all, then, lectures on chemistry without reference to the practical application of the reactions are more in the order of entertainment than instruction.

THEORY AND PRACTICE COMBINED.

The most ideal arrangement is plainly a combination of theory and practice and it is this which I so strongly advocate. To you as foreman electro-platers I would not recommend an exhaustive study of all the branches of chemistry; a course in steel analysis would be of little value to you and courses in such studies as alkaloidal chemistry, food analysis, photo-chemistry, colloidal chemistry, etc., would be of even less value. On the other hand, I feel strongly that you could profitably spend the time in the study of those branches which are of particular interest and which would prove of greatest use to you in your work, such as inorganic chemistry and qualitative analysis. The subject of quantitative analysis is also an important one but would probably prove of less value to you, though it might come in very handy in case of any question as to the amount of an impurity in any of the various chemicals you use. Quantitative analysis would be of no use to you without a certain amount of special apparatus such as burettes, pipettes, dessicators, a fine balance, platinum crucibles, etc., whereas your ability to make use of a knowledge of the other two branches mentioned would require no special apparatus.

THE VALUE OF CHEMISTRY TO THE ELECTRO-PLATER.

But to come to the particular question of the moment: "Would a knowledge of chemistry be of any value to an electro-plater?" or perhaps a still more simple question: "Of what use would a knowledge of chemistry be to an electro-plater?" There are many things which can be said in answer to such questions. In the first place the electro-plater with a knowledge of chemistry would better appreciate what he is doing. The better a workman understands his work, the more intelligently can he go about it. Without a knowledge of what he is doing, he is little more than carrying on the work of a boy; or he even sinks to the level of a mere machine. I once saw a young lad in a beet sugar factory titrating the alkalinity of sugar juice with decinormal sulphuric acid, using phenolphthalein as an indicator. But he had absolutely no idea of what he was doing or why he was doing it. His knowledge was simply this: He was to take up the little tin dipper just full of juice and pour it into a tea cup, and to this he was to add a few drops of the solution in the bottle; he was to read the level of the liquid in the long glass tube and then allow this liquid to run gradually out of the end and into the tea cup until the pink color just disappeared, after which he was to again read the level of the liquid in the tube and subtract the first reading from the second. He did all this entirely mechanically and from a mechanical standpoint he did it well. He knew not the composition of the solution in the burette; he did not even know the name of the apparatus nor of the indicator which caused the sugar juice to turn pink. Without the chemist to furnish the solutions he would have been totally lost. On the other hand, with a knowledge of chemistry he would have been less dependent upon the head chemist; he would have saved the latter individual considerable time and he would have been of considerably greater value both to the head chemist and the sugar company.

A dyer once took his son to the great German chemist Liebig to inquire if he could give the boy a course in dyeing. Liebig replied that he could not teach him dyeing but that he could give the boy a thorough course in chemistry; and he went so far as to state that the lad, with such a knowledge of chemistry, would soon be more valuable in the dyeing establishment than any of the other workmen. Liebig was a great believer in a mixture of theory and practice. In the case of the dyer he felt certain that with a knowledge of chemistry, the boy would make a far better dyer than others who had not had this training, for he would be better able to appreciate reactions and he would know exactly what he was doing; he would be able to distinguish between compounds, and in time of trouble in the works he would be in a far better position to ascertain the cause of the trouble, as well as to work out a solution.

I have already hinted at another service which a knowledge of chemistry may be to the electro-plater, namely in the testing of materials for impurities. Of course the majority of our great manufacturing companies employ chemists and make a business of analyzing absolutely everything in the line of supplies. For those of you who are connected with such companies, a knowledge of chemistry for its use in testing materials is not so necessary. But for the electro-plater connected with a company not employing a chemist, the ability to test substances for impurities may frequently save considerable trouble and expense. Even in a works employing a chemist, if the electro-plater is able to make purity tests, he may be able to save the chemist an appreciable amount of work and hence prove of greater value to the company.

In nearly all industries employing chemical methods, problems and questions are continually arising and this I do not doubt is also true of electro-plating. A precipitate suddenly makes its appearance in one of your tanks: What is it? Another bath is found to contain an unusually large amount of iron: How can it be taken out? The label may have fallen from a large bottle of some white compound. What is it? You may have some sort of an idea of the identity of the salt, but can you be sure? Sodium carbonate comes into the market regularly in two forms, in crystals and as an anhydrous powder. If your formula calls for a certain weight of one, and your purchasing agent has supplied you with the other, how much should be used? Might make a difference. It may interest you to know that 10 ounces of the anhydrous powder are chemically equal to about 28 ounces of the crystallized salt. So if you were making a solution by weight it certainly would make a difference which you used.

When a question arises as to the identity of a compound, its strength or its purity, or when any other kind of a chemical problem arises, the man without a chemical knowledge is liable to "take a chance." Never take chances. I know of nothing worse in chemistry than taking chances, and I have no confidence in one who will take chances along these lines. I would not recommend such a man for any kind of a chemical job.

Now just a word about analysis, and this is more particularly to those among you who are working for firms not employing chemists. Everything in the way of metals and chemicals should be purchased on analysis. It pays. And in the long run it pays the firm to analyze everything in the way of supplies after they are received at the factory and before payment is made. Now it would be comparatively simple for an electro-plater to learn methods of testing chemicals for impurities, and it would not require a very great amount of study for him to sufficiently master quantitative analysis to be able to make simple analytical determinations by volumetric methods. Even if these determinations were only roughly approximate, in the long run it would pay to make them, and in the end it would make the electro-plater more valuable to the company for which he is working.

CONCLUSION.

In closing let me say that I earnestly hope that I have not over-emphasized the importance of chemistry. The world revolved on its axis long before there was any chemistry, and the sun and various planets move about in their respective orbits entirely independent of chemistry. I have tried to not over-strongly emphasize anything though I have endeavored to give you my ideas of the value of theory and practice and the desirability of a combination of the two. To confine ourselves to the particular case in hand, let me suggest that the value of a foreman electro-plater today is in no way dependent upon the color of his eyes, his weight, nationality or church preference; nor is it dependent upon any other outside factor unless it be one which seriously interferes with his work. The real value of an electro-plater depends rather upon his ability to get out work satisfactorily; to do good work and to do it with the proper rapidity; it depends upon his ability to properly direct the men who are assisting him; it depends upon his ability to meet any troubles which may arise and to figure out solutions of these troubles. Or in other words, to use a typically western expression, it depends upon his ability to "deliver the goods." And I firmly believe that a knowledge of chemistry will make an electro-plater much better able to deliver the goods; that it will make him more valuable to his employers. That you, to a certain extent at least, agree with me in this thought is quite evident by a glance into this most orderly and neatly arranged laboratory which you maintain. I only hope that you are all taking advantage of this opportunity and are delving into the theories of chemistry in the endeavor to acquire something of a working knowledge of this science.

I have not attempted to make this address one of condemnation, neither have I attempted to make it one of great instructional value; I have offered it more in the order of entertainment, and if it has proved interesting or entertaining to any of you I will feel amply repaid for the time devoted to its presentation.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

February 5, 1917.

There is no topic more widely discussed throughout the Naugatuck valley these days than the situation that has arisen between this country and Germany, and it is already plain that this locality will play an important part industrially in any special activity growing out of a war with Germany. With the visble effects of the great foreign demand for products of this part of the country on every side, it is but natural that war talk should cause great speculation as to the effects of a war on local industries. The little expedition, which sent the national guard to the Mexican border caused enough of an upset to make it apparent that a war in which the United States would participate must create many new and troublesome problems.

One of the first discoveries made by the newspapers after the announcement that diplomatic relations with Germany had been severed was that the police forces guarding big local plants, where parts of munitions are being made for foreign orders had suddenly been doubled. Another was that the railroads were preparing to place guards at bridges, tunnels, repair terminals and similar points, which might be attacked by enemies of the United States bent on hindering the free transportation of war munitions and supplies in or out of this section. At this writing such guards are being held in readiness for emergency orders which are expected momentarily.

War will mean a great boom in industries hereabouts because the consumption of brass and copper goods and machinery such as is made throughout this section will be greatly increased. Already, within thirty months some of the largest brass and copper plants heerabouts have been completely reorganized and enlarged to several times their old capacity to supply foreign orders, and yet it is doubted if these greatly augmented establishments will be able to allay impatience for new supplies of materials for government use, because of the fact that so little preparation has been made for a conflict of great proportions.

All these elements are more or less generally considered, and the effect has been bullish on the value of stocks in local industries, which had slumped somewhat with the rest of the market since the "peace talks" became noisy.

Business is still at flood tide. The great plants of the American Brass Company, the Scovill Manufacturing Company, the Chase Metal Works, the Waterbury Farrel Foundry & Machine Company, are running at full capacity and keeping every class of transportation service worried about delivering the goods. Another dividend of 10 per cent. has been declared by the Scovill company. From the Chase offices came the announcement a few days ago of a bonus to employees of 10 per cent. Labor is still enjoying a climbing market, though it is apparent that its efficiency is getting more consideration for the sake of avoiding extravagance.

Expansion of plants continues. The Chase Metal Works have acquired the property of the Welch hosiery mill, which will go out of business in June after a long existence. Even hosiery operatives find metal industries more attractive under present conditions, and wages and lack of labor is one of the causes of this great change.

Development of plans for housing metal workers who have come here from other cities proceed rapidly.

Many banquets for factory foremen have marked the past month.

Reports on efficiency courses adopted in factories for employees, with part of the expense borne by the employers, indicate that some of the most skeptical have been convinced that they pay handsome dividends to masters and men. There are no labor troubles. Fire destroyed a considerable portion of the new plant of the Waterbury Brass & Bronze Corporation, near the Scovill plant, during the past month.—F. B. F.

NEW BRITAIN, CONN.

February 5, 1917.

By New Britain manufacturers not only is the present era being accepted as one of unqualified prosperity, but it is also being made one of industrial preparedness. Other than the local manufacturers, no others in the country realize more the gigantic task of keeping up with cheap foreign competition when the European war is over, and to this end many are working. Not only are practically all of the factories making strenuous attempts to increase their lines of sales by stepping in where foreign concerns have had to step out, but they are also, in several instances, making positive strides towards attaining a standing in new and foreign fields. This is especially true at the American Hardware Corporation where it is known that South American trade is being considered. The Trumbull Electric company too, is edging in on the Latin-American trades and recently representatives from South America and Australia were at the Landers, Frary & Clark plant preparatory to returning to their own fields to further boom "Made in New Britain" articles. The Stanley Rule & Level Company, hardest hit of all local concerns at the outbreak of the great war, has completely recovered from the loss of extensive European trade and has built up a domestic and southern trade to off-set it. Steel tools are the chief output of this plant. While steps are being taken to enlarge the sales, in the minds of managers and directors of each concern are plans to increase the size of the factories. Perhaps no other concern has had the wonderful industrial growth of Landers, Frary & Clark, not only the largest cutlery concern in the world, but also one of the most versatile in the variety of articles turned out. At this plant several new factory buildings are either in the hands of the designers or already in process of construction. While a majority of the local plant specialize in some particular thing, such as steel machines, brass moulding, etc., the Landers, Frary & Clark plant is most diverging. Steel is used for cutlery. Aluminum is used extensively in the manufacture of percolators and other domestic articles, quantities of brass are used for plates, German silver is another important metal used as is solid and sterling silver, copper and bronze is used extensively and other important metals have their use here, so that anything affecting the metal market in the least is at once reflected by this company. Notice has been given of an increase in the Landers' capital stock and it has just been voted to increase the stock of the New Britain Machine Company. Other concerns are expected to make important announcements by spring, and in almost every instance the stock increases voted by the stockholders has been to provide capital for extensions.

While business in all lines of metal manufacturing is very good, it might be noted that the brass business is excellent. The Bristol Brass company, the largest brass mill in the state, excepting the American Brass company's plant at Waterbury, is away behind in its orders. The mills are run continuously, day and night, and so rapidly has the business increased that new additions have proved inadequate. So rapidly has this plant grown that it is impossible to find housing accomodations for its large number of employes and even now, during the winter, many of them have to sleep in a "city of tents" erected by the factory nearby. These men are provided with meals at a factory managed boarding house.

The New Departure Branch of the United Motors Company is likewise rushed. So much so that housing accomodations cannot be found for employes in Bristol and the company has been compelled to go into the real estate development business on the side. A community has been built up where men with families can rent homes, and a large hotel in Bristol has been purchased and refitted, even to a library and recreation room, for the single employes. Business at the American Silver plant was never better.—H. R. J.

HARTFORD, CONN.

February 5, 1917.

The new year promises to spell prosperity for the metal industry in Hartford and vicinity. Since the first of the month every factory has been busy, many of them working two shifts of men, and as long as the war continues it is to be expected that the demand for metal products will be more than normal.

Business is especially good with the manufacturers of metal munitions of war. A bill authorizing Colt's Patent Fire Arms Manufacturing Company to increase its capital stock from $2,500,000 to $10,000,000 was introduced in the state senate on January 18 and was referred to the committee on incorporations, which is said to favor the bill. The bill also provides that the directors at their discretion may issue the stock at par value, or such a price in excess of par as they see fit. It also carries the right to issue stock dividends, in which case credit for such stock issued shall be given on the stock ledger by a transfer from surplus account. The directors of the Standard Screw Corporation, also engaged in the munition trade, at a meeting held on January 25 declared a dividend of $50 a share on common stock of the company. The Hartford Machine Screw Company is a subsidiary.

At the annual meeting of the stockholders of the Hartford Auto Parts Company, the directors were re-elected and J. M. Carney, vice-president and general manager, reported that the production of the past year was double that of 1915 and 600 per cent. better than in 1914. The regular 3 per cent. annual dividend and an extra dividend were declared on the common stock, while the preferred dividend remains 7 per cent. According to vice-president Carney, the capacity of production in 1917 has already been contracted for. The directors chose the following officers: president, C. C. Chamberlain; vice-president, J. M. Carney; treasurer, John H. Trumbull; secretary and assistant treasurer, Harry W. Biglow.

Embargoes on freight have hampered the local manufacturers for some months, but freight is now moving freely, considering the heavy volume of business and according to the modification of the embargo still effective, less than carload shipments for coastwise steamship lines will be accepted by the New York, New Haven & Hartford Railroad.

The brisk trading in local metal goods manufacturer's stock reported by local brokers is indicative of the favorable condition of the business being transacted, Niles-Bement-Pond Company, John-Pratt Company, Billings & Spencer, and Standard Screw Company shares being particularly active. The Sigourney Tool Company; The Whitney Manufacturing Company, manufacturers of high grade driving chains, Pratt & Cady Company, Inc., The Hart Manufacturing Company, makers of the "Diamond H" switch, The Atlantic Screw Works and the Smith Manufacturing Company, all report that business is improving.

The Colt's Patent Fire Arms Manufacturing Company has given the citizens of Hartford assurances that there will be no repetition of a recent accident in which a Vicker's machine gun, being tested at the factory, bombarded the city with a shower of bullets. Fortunately no one was injured and hereafter the testing will be directed away from the city.

A certificate of organization of the Seifert Special Machine Company of Hartford has been filed with the State Secretary. The capital stock is given at $50,000, divided into 500 shares. The petition is signed by M. A. Thorpe, Thomas E. Canfield and Edward T. Canfield.—T. C. W.

BOSTON, MASS.

February 5, 1917.

During the expiring month not a few houses have declined munition work for the simple reason that the capacity of their plants is taxed to the utmost by what may be termed "legitimate" business. Reports from various parts of the state show that this refusal to take advantage of a highly lucrative phase of business is spreading. There are signs, too, that the abnormal condition that has prevailed during the past eighteen months, owing to this very munition trade, is beginning to diminish.

An indication of this is apparent in the increased number of semi-skilled mechanics, who earlier in the war were regularly employed at a high wage, but who are now seeking employment. There is, however, just as much demand for the skilled man as ever.

Several of the local shops which have been paying war bonuses have reduced them, and many which have been running overtime have discontinued extra hours. This, too, is borne out by the fact that the employment office of the Boston branch of the National Metal Trades Association has been busier than usual attending to applications of men seeking work. This must not be taken to mean that machine shops are not busy at the present time, but there is not the tremendous rush there was three months ago, or a year ago.

Naturally the first week in January was comparatively quiet. The fact that January 1 for the first time was observed as New Year's Day throughout the state, and that a great many establishments are busy stock taking has had a deterrent effect upon the market, but there is every prospect that the succeeding months will maintain at least as high a standard as during the past year.

Keen satisfaction is felt that the American Foundrymen's Association and the American Institute of Metals will hold their annual convention in Boston this year. The date set is September 24-29. The local association, or rather the New England Foundrymen's Association, of which Fred. F. Stockwell of 205 Broadway, Cambridgeport, is president, is particularly pleased, and naturally the members will outdo themselves in their efforts to make the visit of the national association one long to be remembered. The decision to hold the 1917 convention here is the result of the efforts of the Boston Chamber of Commerce Convention Bureau, working in co-operation with the New England Foundrymen's Association. The final decision was reached when a special committee of the American Foundyrmen's Association came to this city the week of January 8, at which time a luncheon was arranged by President C. F. Weed in their honor, and the necessary details to secure the convention arranged. The guests and representatives were V. E. Minich of New York, R. A. Bull of Granite City, Ill., S. T. Johnston and C. E. Hoyt of Chicago, Ill.

The American Foundrymen's Association convention is one of the largest and most important of its kind held in the United States, and at its convention, in conjunction with those in attendance at the American Institute of Metals meeting, brings an attendance of more than 5,000 persons. In connection with the convention an exhibition of foundrymen's supplies and equipment is held. This in previous years has been held in the cities of Chicago, Cleveland, Pittsburgh, New York and Atlantic City, but 1917 will find them holding their first exhibition and convention in the city of Boston. Over 300 tons of foundrymen's supplies and equipment will be exhibited during the week of the convention, and arrangements have already been concluded with the management of Mechanics Building to hold the enormous display in that building during the week the convention is in session.

Boston feels particularly fortunate in securing the convention, for a large number of cities, including one in this state, had been making the strongest kind of bids for the assembly. No effort had been spared by the convention bureau to show the foundrymen that the "Hub" was the logical place for their 1917 meeting.—R. T. E.

ROCHESTER, N. Y.

February 5, 1917.

The metal market in Rochester and vicinity is ruling rather strong at this season. Demand is heavy and delivery handicapped by the same conditions that prevail throughout the United States. But one metal shows a decline in local consumption, and that is aluminum. Persons in authority say users are merely drawing on stocks accumulated in warehouses at present.

Jobbers in metals and salesmen are of the opinion that this will be another big year in manufacturing in Rochester, and for that reason purchasing agents are keeping in close touch with the situation in all parts of the country. The continued high price of copper is a source of anxiety here, and it is feared that figures will make another advance within a few months. Even scrap copper is dearer in Rochester.

All of the metal-using concerns here are running at full speed, and some find difficulty in obtaining supplies. The outlook is promising, and consequently no apparent change has been noted in any establishment in the city. Much

difficulty is experienced in obtaining brass, the demand for which of late has been greater than the supply.

One large concern here stated today that because of the high prices of copper their orders for $14,000 worth of metal had been turned down, unless delivery could be delayed for six months. It was the opinion of the manufacturers that the continuation of "peace talk" would help to ameliorate conditions in the metal market.—G. B. E.

COLUMBUS, OHIO

February 5, 1917.

The metal market in central Ohio territory is more active than was the case a month ago. The demand is gradually increasing and prices have advanced in accordance with the larger volume of orders. The tone of the market is generally good. Available stocks are fairly large and, although the car shortage is delaying shipments, not a great deal of inconvenience has resulted. According to metal dealers and jobbers, there are bright prospects for the future. It is believed that prices will continue high for some time to come.

Brass is up from the records of a month ago. No. 1 red brass scraps is now selling at 23 1-3 cents while yellow brass is quoted at 20½ cents. Copper is held strongly at 30 cents. Aluminum is holding steady at previous levels, which are around the 50 cent mark. Zinc and spelter are both advancing and the same is true of babbitt and all type metals. Lead is one of the strongest points in the market.

Preparations are made for an active season during the spring and all metal manufacturers are looking forward to larger requisitions. Several new metal using concerns have been started in central Ohio territory recently.—J. W. L.

CANTON, OHIO

February 5, 1917.

With little more than a half month of 1917 gone, eleven Canton plants, including five new ones, and six which have built, or will build additions, will require during the year a minimum of 5,800 new workers.

The different plating concerns all report orders coming in fast, and there is not quite the lack of skilled labor at the present time in this line of work that has been handicapping these concerns in the past months. Columbia Brass and Bronze Wire Works, makers of all kinds of fancy wire, are busy and expect still more orders. The Alliance Brass Foundry report business exceedingly good and receiving large orders for contract work.

The coal shortage, which was felt here as well as other places, is somewhat lessened.

Local prices of metal has declined a little during the month of January and are ruling as follows: Light brass, 8 cents; heavy yellow, 14 cents; heavy red, 21 cents; copper, 23 cents; aluminum, 34 cents; zinc, 9 cents, and babbit metal, 8 cents.—E. T. S.

CLEVELAND, OHIO

February 5, 1917.

Forty new industrial establishments for Cleveland within the next few months is the possibility as the result of the activities of the Cleveland Chamber of Commerce industrial development committee in its annual question to 3,300 members. While no figures are available for publication, at the offices of the committee it is admitted that several of the plants likely to select Cleveland as their permanent location will be engaged in the manufacture of products taking much non-ferrous metals. Among these will be producers of sheet metal parts for different machinery, notably automobiles.

Among the latest to take up headquarters here is the Brass and Copper Rolling Mill Company, at Babbit Road; Euclid, Ohio. This plant, together with others added to Cleveland's roster during the last six months, gives this city an additional manufacturing area of 4,000,000 square feet.

If plans of promoters go through, a $2,000,000 corporation designed to make Cleveland a self-contained automobile producing center, will be organized here. Overcrowding of some plants, and lack of others for producing all materials and accessories entering into the manufacture of automobiles, is hampering the business here, it is claimed what is needed particularly, according to those back of the project is the production of materials embodying brass, copper, nickel and aluminum.

The Marvel Accessories Manufacturing Company, makers of automobile accessories, is the latest plant to start more extensive operations, just completing a $60,000 factory on the East Side. The new factory will give the firm 25,000 square feet of space compared with 1,200 in the old quarters.

Considerable damage to the establishment of the Scott-Ullman Company, manufacturers of electrical fixtures, Perkins avenue and East 34th street, was done when sparks from machinery ignited liquids in the plating room of the plant. The blaze stated on the second floor and extended to other parts of the building. Fifty employes were driven to the street. Robert Ullman, president of the company, places the loss of stock at $10,000 and damage to the building at $5,000, both of which were covered by insurance.

An explosion was narrowly averted in the plant of the Central Brass Manufacturing Company, Cedar avenue and East 62nd street, when flames menaced a quantity of gasoline stored nearby. The material was removed before the flames reached it. The damage was kept down to $2,500.

The United States Bronze Company has sold land and buildings at Girard avenue and Columbus Road, which will be used by the Factory Equipment Company. The property is 100 by 58 feet, and there is 30.000 square feet of floor space in the buildings.

Removal of the factory of the Engle Aeroplane and Motor Company from Buffalo to Cleveland, plans for which are under way by Cleveland capitalists, is expected to afford another angle for outlet of aluminum and other non-ferrous metals.—C. C. C.

CINCINNATI, OHIO

February 5, 1917.

While there were some signs of quiet in the metal trades around the first of the year, the result largely of the usual holiday spirit, there is little remaining of this just now, as operations have been resumed in full vigor, on the basis which existed around the latter part of 1916. As far as indications go at local foundries and machinery plants, business will continue in excellent volume for an indefinite period, the talk of cessation of war orders having had little or no effect on activity. The prosperity of the country as a whole, reflected faithfully in the building trades and in the expansion in manufacturing operations, has naturally affected the metal trades in all branches, and it is this general demand for manufactured goods, nearly all of which involve the use of the metals to a greater extent, which furnishes such a satisfactory basis for the activity of the trade. Contracts for metal supplies are made confidently, in many instances, in spite of the still high level of the market, and in every respect the feeling is evident that there is little danger of any real shock to the permanent structure of business.

The Edna Brass Works, of Cincinnati, which has just completed a substantial addition to its manufacturing facilities in the shape of a good-sized building, is receiving estimates on still another structure, which will contain a machine-shop, stock room, shipping room and a basement garage. The building will measure 90 by 130 feet and will front on the Cincinnati, Lebanon & Northern Railroad.

The officers of the Buckeye Iron & Brass Works, of Dayton, O., entertained the department heads of the company at dinner at the Phillips House recently, with the object of giving all concerned a closer touch with the general affairs of the company. The plans for the proposed new plant in Edgemont were discussed, among other things, and nearly all of the eighteen present made short talks. W. B. Anderson presided as toastmaster. Suits of a distinctly unusual nature were filed in Toledo, O., on January 27, by six workmen, against the Consolidated Manufacturing Company, which is said to have large shell contracts. The suits allege that the men suffered impairment in health from lead fumes, and aggregate damages of $125,000 are asked.—K. C. C.

DETROIT, MICH.

February 5, 1917.

Brass, copper and aluminum plants are experiencing considerable trouble obtaining coal, and for a week the situation became so serious that many plants prepared to close for a time. However, the embargo placed on all shipments, excepting coal and food products, has improved conditions, and at present all plants are working to capacity and with a fair supply of coal. However, the relief is said to be only temporary, and it is believed that the coal shortage will be again felt severely before the winter is over. It is reported that 12,000 freight cars, loaded with coal and manufacturing supplies, lie in Detroit and Windsor, Ont., yards waiting to be unloaded.

Notwithstanding the season's aggravating conditions many plants in Detroit are planning for a heavy volume of business and are making extensions accordingly. The automobile companies, which use great quantities of brass, copper and aluminum, are planning to make 1917 the banner year of the business. The Ford Motor Company, the Cadillac Motor Car Company, the subsidiary companies of the General Motors Company and also the Maxwell Company, together with about fifty other concerns, including accessory plants, are taking on new men. The automobile show just closed apparently has proven to manufacturers that 1917 will excel all others as to orders and output. The show was one of the largest in the country and said to stand next to that held in New York city. The exhibition was held in the Old Billy Sunday Tabernacle and had the greatest display of brass, copper and aluminum accessories in the history of the business here.

While the automobile trade seems to lead off, manufacturers of plumbers' and other supplies, requiring brass, copper and aluminum, all report a good business; in fact, the greatest in the city's history. At present the shipbuilding companies here, which do a tremendous business, are assisting in making the brass trade boom. The yards are filled with lake and ocean going ships, and launchings are reported often during the week. The Detroit Shipbuilding Company has a number of large contracts for ships for foreign countries, and many of these will be ready for service the coming spring. These boats are all heavily equipped with brass and copper fittings, including plumbing supplies.—F. J. H.

A review of the manufacturing metal industry for the first month of the year in Detroit is very promising. Many industries in the metal lines have developed to such an extent that variety of output as well as volume has increased to a surprising extent.

Harry Brothers Manufacturing Company has moved into its new plant, located corner of Woodbridge and Rivard streets. The latest improved and most expensive machinery has been installed for the use in making parts made of sheet brass, zinc, copper, tin or aluminum.

The Superior Seal and Stamp Company, Jefferson avenue, has large orders on its books, and in order to take care of their Canadian trade they have opened a Canadian branch factory, located at Windsor, Ontario.

The City Brass Foundry Company, manufacturers of brass, bronze and aluminum castings, are taxed to their capacity to take care of orders.

The Kerr Valve Company, located at Walkerville, Ontario, have resumed full operations, manufacturing its line of steam valves and specialties. They report the demand for its goods at this time is above normal.—P. W. B.

LOUISVILLE, KY.

February 5, 1917.

Reports from leading coppersmiths of the Louisville district are to the effect that business is holding up extremely well, and practically every house is good and busy at this time. While there has been less distillery work than usual, commercial lines of various kinds have shown improvement, and the demand for copper work, castings, plating, etc., is showing up well.

The high copper market apparently is having no bad effect on business due to the fact that consumers have to have the material and are buying regardless of market conditions. Prices advanced somewhat during the month and apparently the market is strong and steady. Copper tubes, base price, are quoted at 47½; brass tubes, 44; sheet copper, 42½; ingot, 28½@32½. It is said that these ingot quotations are lower than the price at the mine, a good many concerns which had bought heavily on futures, becoming alarmed over peace rumors and having undersold the market, which based on mine quotations should be about 35½. Scrap copper is commanding about 26 and scrap brass, 16.

Albert Grall, engraver located in the Tyler Building, has installed an electroplating and sponge bathing plant for handling Sheffield and other work, especially where the under metal has been exposed in engraving. This is the first engraving shop in Louisville to put in its own plating plant, the others having always sent out their work to established platers.

A reorganization has been effected in the management of the American Brass & Plating Company, and amended articles of incorporation have been filed. Under the provisions of the amendment any stock offered for sale must first be offered to the existing stockholders. Louis Rindt, formerly head of the Art Brass & Plating Company, later the Rindt Company, is president. The Rindt Company, some time ago was merged with the E. A. Stege Manufacturing Company, as the Stege-Rindt Company, and was later changed to the Stege Brass & Plating Company, when Mr. Rindt withdrew. Other officers of the American Brass & Plating Company, are James A. McGill, secretary-treasurer, and Joseph H. McGill, vice-president. The plant was purchased by the McGills about two years ago from Hines & Ritchey.

The Columbia Sanitary Manufacturing Company, manufacturers of plumbers' supplies of various kinds, and enamelers, has placed orders for four motors, of 20 h.p. each, and is enlarging and improving the plant at Louisville.

The Standard Sanitary Manufacturing Company, recently gave a big banquet at the Watterson Hotel, of Louisville, at which department heads officers, and visitors from Pittsburgh, Pa., some fifty in all, were present. Theodore Ahrens, head of the company, was one of the chief speakers.—O. V. N. S.

TRENTON, N. J.

February 5, 1917.

Some of the metal industry plants in this city have been greatly handicapped during the past month because of a scarcity of raw material in the market. The J. L. Mott Company is still away behind with its orders because of being unable to get in a needed supply of copper and brass. This also had some effect upon mechanics who were compelled to be idle until material arrived at the plants.

The plant of Morris Movshovitz & Son, situated along the Delaware River, was compelled to close down for two weeks when the supply of raw material for the manufacture of zinc ran out. A new supply has been secured and the plant is running full handed again.

The Skillman Hardware Manufacturing Company is very busy and additional help was engaged during the month. The company also expects a very busy spring and summer. The Billingham Brass and Machine Company is enjoying a busy season and extra bench molders were given employment recently.

The only Trenton plant where ammunition is being turned out at the present time is the Mott Company. The concern is now working on its third order for ammunition for the European nations. The third order is said to be as large as the first one, calling for an outlay of $5,000,000 for time fuses. The order is not being rushed and only about half the number of mechanics are employed.

A new plant to be added to the metal industry of Trenton will be the new works to be built here by the Westinghouse Lamp Company, a subsidiary corporation of the Westinghouse Electric Company. The company has purchased a tract of land of five and a half acres on Pennington avenue and will erect a factory for the manufacture of incandescent lamps. The company paid $40,000 for the tract and will erect a plant to cost many thousand dollars.

It is rumored in metal circles here that the Bordentown, N. J., plant of the Standard Fuse Corporation may be removed to Canada. Some of the bosses at the plant have been

transferred to the Canada plant. The company is manufacturing partially completed fuses, which are given the finishing touches at Paulsboro and then shipped to Europe. Some of the employees of the Paulsboro plant were transferred temporarily to the Bordentown works during the month to complete a job at a certain time.

The Riverside Watch Case Company, which is working on a big order for fuses for the European nations, is still engaging experienced help.

The Billingham Foundry and Machine Company, the Trenton Brass and Machine Company, the Trenton Smelting and Refining Company, the McFarland Foundry and Machine Company, the National Electro Plating Works, the Bechtel Engraving Company, the Clifford Novelty Works, and the Mercer Automobile Works are also very busy. The East Trenton Electro Plating Works is working overtime to turn out its work.—C. A. L.

NEWARK, N. J.

February 5, 1917.

The year 1916 was a good one with local concerns. From the way that 1917 has started out it looks as if it might exceed last year. The month of January was somewhat broken up by taking of stock by some concerns and by semi-annual alterations, repairs, etc. Many firms did not send their salesmen out until the latter part of the month. This had a tendency to limit the actual sales made during the month, but as it is the normal situation in the opening month of the year, it does not adversely affect the year's business. Metal manufacturers have an advantage now over a year ago in that there is a greater confidence in business circles now than there was a year ago, and there is more money in circulation. Manufacturers almost without exception expect good business this year, and there is a feeling that, when the salesmen get really started on their year's work, a large volume of orders will come pouring in. Some manufacturers are a little fearful that in case of peace there will be another readjustment of business which will work hardship to the manufacturers. Still others, while expecting a readjustment which may affect some concerns in some lines, think that other concerns will benefit correspondingly, and that business as a whole will continue to be good.—R. B. M.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The New Jersey Zinc Company, New York, will erect a mill at Palmerton, Pa., for the rolling of zinc metal.

N. B. Pritchard, manufacturer of white metals, such as babbitt and type metal, solder, shrapnel bullets, etc., 40 Quebec street, Sherbrooke, Quebec, Canada, will build a metal-working factory to cost $8,000.

M. A. Purvin has been appointed manager of the Chicago office of the United Smelting & Aluminum Company, New Haven, Conn., which will be located at 959 Monadnock Building, Chicago, Ill.

Goldschmidt Thermit Company, 120 Broadway, New York, has purchased sixteen lots in Jersey City, N. J., on Johnson avenue and Bishop street, to provide additional space for the future expansion of its works.

The Cleveland Metal Products Company, Cleveland, Ohio, has increased its capital from $1,000,000 to $10,000,000, and the Regle Brass Company, Marysville, Ohio, increased its capital from $11,000 to $36,000.

The St. Catharines Brass Works, manufacturers of brass, bronze, copper, and aluminum castings, St. Catharines, Ontario, Canada, is erecting an addition to its foundry, 50x80 feet, which will cost approximately $8,000 and not $30,000, as was published.

The Oneida Community Limited, Sherrill, New York, announces that it will distribute among its employees on or about February 10, $270,000. Every employee in Sherrill, N. Y., Kenwood, Lititz, Pa., and Niagara Falls, Canada will share in the distribution.

The Lima Metals Foundry Company, Lima, Ohio, recently incorporated with a capital stock of $15,000 to specialize in brass, bronze and aluminum castings, has elected A. H. Workman, president; J. F. Racine, vice-president, and W. J. Noonan, secretary and treasurer.

Matthew Tanzola, 48 Adams St., Newark, N. J., announces that he is specializing in soldering of all kinds. He is doing a great deal of silver soldering on mirrors, brushes, comb-backs and other toilet-ware, etc., as well as soft soldering and brass soldering, both job and contract work.

W. A. Fuller, well known as an expert plater and chemist, and formerly representing the J. B. Ford Company, Wyandotte, Mich., has organized The W. A. Fuller Company, with headquarters at Pittsburgh, Pa., to deal in industrial chemicals. They are putting on the market a new cleansing material called Natrolin.

A. Allan & Son, 486 Greenwich street, New York, manufacturers of Allan anti-friction metal, have filed plans for a new foundry 50x100 feet to be erected at South Fifth and Bergen streets, Harrison, N. J. and which will cost $15,000. This is the first of three buildings which this company contemplates erecting on this property.

Land adjoining the plant of the E. T. Fraim Lock Company, Lancaster, Pa., has been acquired for the erection of an addition to double the present capacity. The company manufactures locks of all kinds and operates a foundry, tool room, grinding room, and plating, stamping, polishing, japanning and lacquering departments.

The United States Metal & Manufacturing Company, 171 North avenue, Plainfield, N. J., will hold a meeting on February 20, at the Plainfield office to allow the stockholders to take action on a resolution calling for the dissolution of this corporation. The meeting has been called by R. G. Jeffery, secretary of the company.

The Roessler and Hasslacher Chemical Company, Perth Amboy, N. J., has commenced the erection of an addition to its plant on Rector street. A new one-story brick and steel structure will also be erected on the west side of the street. The company, it is said, is planning for further extensions to its plant to cost about $1,000,000.

Herman J. Hegt, 309 Broadway, New York City, announces that he can offer deliveries of sheet brass, brass rod and brass wire in from one to six weeks depending on requirements. This delivery should be of considerable assistance to those manufacturers who use moderate quantities of this material and are unable to accommodate their requirements or are unwilling to pay the high prices that are being charged for stock deliveries.

The Brown's Copper and Brass Rolling Mills, Ltd., New Toronto, Ontario, Canada, announces that they are not contemplating the erection of a wire mill as was reported, as that plant has been practically completed, but they are contemplating the erection of a large plant for the manufacture of brass and copper tubing and propose to begin work on this plant in a week or so.

The Tallman Brass Company, Hamilton, Ontario, Canada, has awarded a contract for an addition to its plant calling for 25,000 square feet of extra floor space, part of which will be used for machine department and the balance for increased trade. A brass, bronze and aluminum foundry, brass machine shop, tool room, grinding room, and spinning, stamping, tinning, brazing, soldering, plating, polishing and lacquering departments are operated by this company.

The Buffalo Foundry Foremen's Club gave a very successful banquet on January 20, 1917, at Buffalo, N. Y. The caterers for the occasion were the E. J. Woodison Company, of Detroit, Mich. A noticeable feature about the banquet was the clever adaption of current shop efficiency terms to the various dishes making up the menu. We have no doubt but that the diners exhibited hundred per cent. efficiency in making away with the things offered. W. J. Wark is secretary of the Buffalo Foundry Foremen's Club.

Eighty representatives of the Trenton, N. J., and Waterbury, Conn., plants of the Ingersoll-Trenton Watch Company attended the annual convention of the concern's salesmen, which was held at the Trenton House, Trenton, N. J., during the month. All the salesmen reported business good in all sections of the country and predicted that the company would enjoy another prosperous year. George F. Eberhard, general superintendent of the Trenton plant, announced that the company is now turning out 5,000,000 watches a year.

The Parker Rust-Proof Company of America, Detroit, Mich., have announced that they have completed negotiations for the purchase of the Coslett patents for Coslettizing purposes, Nos. 870,938 and 1,007,069, and that in connection with the following patents owned by the corporation it now controls the entire rust-proofing art: Richards patent, No. 1,069,903, dated August 12, 1913; Allen patent, No. 1,200,075, dated November 28, 1916; Allen patent, No. 1,167,966, dated January 11, 1916; Parker patent, No. 1,185,343, dated May 30, 1916; Parker patent, No. 1,211,218, dated January 2, 1917. The company contemplates the erection of a large nickel plating and enameling plant in connection with the rust proofing.

CHANGE IN NAME

The Eastern Brass & Ingot Company of Waterbury, Conn., announces the change of its name to that of the Eastern Brass & Ingot Corporation of New York. No change is occasioned in regards to the personnel of the management or the interests concerned in the business.

REMOVAL

The Carlisle & Gale Company, formerly located at 81 Wareham street, Boston, Mass., has moved its office and works to 5 North street, East Cambridge, Mass., where it will have increased capacity and improved facilities for manufacturing and will be in a position to offer customers better service and prompt deliveries.

FIRE

The Manhattan Brass Company, First Avenue and 27th and 28th streets, New York, announces that only one of its factory buildings on 28th street, together with the offices were destroyed by fire on January 20. The company was able to operate its foundry, rolling mills, tube shops and other manufacturing buildings a few days after the fire occurred, as they were practically uninjured. Temporary quarters have been secured for continuing the manufacture of goods made in the 28th street factory.

FINANCIAL REPORTS

International Nickel Company, which produces practically all the nickel metal in this country, reports for three months, ending December 31, an increase in surplus for dividends, compared with 1915, of $1,052,000. For nine months surplus after dividends increased $1,829,000, and after dividends of over $5,000,000 on the common stock there was a surplus of almost $5,000,000. The balance sheet of the company shows accounts payable of every kind, including preferred dividends due, of less than $2,300,000 against which there is $5,400,000 cash and certificates of deposit, call loans, accounts receivable and inventories were considerably over $8,000,000, to say nothing of $3,000,000 investments.

The American Brass Company's report of earnings for the year ended December 31, 1916, were as follows:

Net profit	$10,991,669
Dividends	3,750,000
Balance	$7,241,669
Previous surplus	13,645,610
Profit and loss surplus	$20,887,279

ELECTION OF OFFICERS

At the annual meeting of the Falcon Bronze Company, Youngstown, Ohio, G. A. Doeright was re-elected president, John Noll, vice-president; H. Z. Kelly, secretary and E. E. Miller, treasurer. The company manufactures brass and bronze castings for rolling mills and steel plants and also other brass products.

At the annual meeting of the stockholders of the Franklin H. Kalbfleisch Company, manufacturers of chemicals, held at 31 Union Square, New York, on January 10, the following officers and directors were elected for the ensuing year: Franklin H. Kalbfleisch, chairman; Robert S. Perry, president; Alfred B. Savage, vice-president and treasurer; Richard Sheldrick, secretary, and Franklin H. Kalbfleisch, Robert S. Perry, Alfred B. Savage, Richard Sheldrick and Harry L. Derby, directors.

At a meeting of the stockholders of the Hamilton & DeLoss, Inc., Bridgeport, Conn., the following officers and directors were elected: Harold H. Hamilton, president and general manager, Harry H. DeLoss, vice-president and treasurer; George C. Gerrish, secretary and H. H. Hamilton, John F. Harman, Parker D. Handy, H. H. DeLoss and James A. Marr, directors. The company was recently organized with a capital of $300,000 to conduct a general stamping and blanking business in all metals including sterling silver, brass and sheet steel. The company has secured a site for a factory near the Handy & Harman plant in Bridgeport, Conn., and is erecting a structure to cost $100,000.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the name of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To manufacture and sell brass.—Herzog Lamp Company, Union, N. J. Capital, $25,000. Incorporators: E. J. Simon, John T. Simon and William F. Herzog.

To manufacture plumbing supplies.—The Indiana Brass Company, Frankfort, Ind. Capital, $100,000. Incorporators: J. A. Johnson, C. E. Williams and T. M. Ryan.

To do a plating, polishing and lacquering business.—The Ford Brass Company, Springfield, Mo. Capital, $10,000. Incorporators: H. T. and T. M. Ford and J. A. Gammon.

To deal in zinc.—The Ohio Zinc Company, Akron, Ohio. Capital, $10,000. Incorporators: Henry T. Reynolds, James C. Reynolds, Fred R. Holibaugh, James C. Thomas and Charles H. Stahl.

To Manufacture Metal Products.—The Palbro Manufacturing Company, Cleveland, Ohio. Capital, $75,000. Incorporators: E. P. Strong, George Q. Keeley, Fred Desberg, F. A. Cook and S. I. Powell.

To Manufacture Metal Products.—The Lima Metals Foundry Company, Lima, Ohio. Capital, $15,000. Incorporators: W. J. Noonan, Alonzo G. Bush, Sol Wissenthal, Ren Rhodes and John Thomas.

To manufacture metal products.—Hollander Manufacturing Company, Cleveland, Ohio. Capital, $10,000. Incorporators: Joseph Hollander, Lena Hollander, Harry Schanberg, Julius Holstein and J. Hudik.

To do metal stamping.—The Economy Metal Stamping Company, Cleveland, Ohio. Capital, $200,000. Incorporators: Richard Ryan, W. L. Barendt, Frank W. Smith, E. H. Arnold, Irving Barendt and others.

To Manufacture Metal Products.—The Akron Metal Products Company, Akron, Ohio. Capital, $100,000. Incorporators: Herbert P. Lawrence, M. B. Glore, W. C. Tappenden, D. W. Dennett and Thomas Brennan.

To manufacture plumbers' supplies, etc.—J. P. Eustis Manufacturing Company, Cambridge, Mass. Capital, $103,000. Incorporators: Edward A. Casey, president; John P. Eustis, treasurer, and Frank O. White.

To Manufacture Electric Fixtures.—Campbell Lamp Company, Jersey City, N. J. Capital, $100,000. Incorporators: Charles A. Campbell, Henry W. Van Allen, Brooklyn, N. Y.; Essie C. Abell, New York, N. Y.

To manufacture brass articles.—The Schwander Brass Manufacturing Company, Cleveland, Ohio. Capital, $40,000. Incorporators: J. Sylvester, L. J. Kohn, Franklin H. Farasey, E. C. Landsman and L. M. Young.

To manufacture metal products.—The Canton Metal Products Company, Canton, Ohio. Capital, $1,000,000. Incorporators: Harry C. Bow, R. L. Kreighbaum, J. B. Immler, H. L. McKenzie and E. W. Stevens.

To manufacture metal products.—The Brooklyn Specialty & Manufacturing Company, Cleveland, Ohio. Capital, $10,000. Incorporators: Leopold Haug, Carl Bearwalde, James Plachy, Joseph Palfy, Charles Wizek and others.

To manufacture metal stampings.—The W. & S. Manufacturing Company, Worcester, Mass., has been incorporated under the name of the Worcester Stamped Metal Company, with a capital of $150,000. The company will extend its plant and install new equipment.

To manufacture Columbian manganese bronze. — The Columbian Bronze Corporation has acquired nearly all of the capital stock of the Columbian Brass Foundry, at Freeport, L. I., N. Y., and the business will be carried on by the Columbian Bronze Corporation. The officers of the new company are Louis J. Hall, president; William G. Miller, vice-president; Valentine G. Walters, treasurer, and Robert A. Patrick, secretary. The company has a bronze, brass and aluminum foundry, brass machine shop, tool room, grinding room, casting shop, brazing, tinning, soldering, polishing and japanning departments.

INQUIRIES AND OPPORTUNITIES

Under the directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

PRINTED MATTER

Power Hammers.—The United Hammer Company, Boston, Mass., announce in a four-page folder that they have purchased the power hammer business of the E. & T. Fairbanks & Co., of St. Johnsbury, Vt., and are prepared to furnish complete Fairbanks' power hammers of all sizes for prompt shipment.

Presses.—The Consolidated Press & Tool Company, Hastings, Mich., has issued a comprehensive catalog, completely illustrated, and giving full description of the various styles and types of presses made by this company. These presses include bench, inclinable and adjustable table and gear power presses for use in the production of all kinds of metal press work. Copies of the catalog may be had upon request.

Pickling Machines.—The Mesta Machine Company, Pittsburgh, Pa., has issued Bulletin M, which describes the Mesta improved pickling machine. These machines, which were first described in THE METAL INDUSTRY in September, 1915, are used for pickling all sorts of metal products such as castings, wire coils, cartridge cases, tubing, stampings, small forgings, gun parts and numerous other products of brass and copper. Copies of the bulletin may be had upon request.

CHEMICAL ENGINEERING CATALOG

Chemical Engineering Catalog. — In the Chemical Engineering catalog recently issued we have another of those constantly recurring instances of the typical American tendency to do something in a radically better way than it has ever been done before, and at the same time to do it more cheaply by doing it more scientifically.

In order that the catalog may be of maximum value to those interested, its preparation is under the supervision of a committee on which are representatives of the American Institute of Chemical Engineers, the American Chemical Society and the New York Section of the Society of Chemical Industry. In order to broaden the scope of this supervision the American Electrochemical Society has been asked to name representatives to act on this committee.

SILVER REVIEW

Silver.—A complete review of the silver market for 1916, written by John F. Harman, chairman of the Board of Handy and Harman, New York, silver manufacturers, for the Journal of Commerce, New York, has been reprinted in pamphlet form and makes most interesting reading to those connected with the silver business. The gist of the pamphlet is as follows: "So far as production from the mines is concerned there is no material change from the output of last year. Mexico's output is still curtailed on account of the unsettled political and economic conditions, while in the United States and Canada the mining operations will probably approximate a yield of one hundred million ounces.

"The future of silver is wrapped up in too many problems to warrant a forecast, but it is the conviction of many, even after the war is over, and with the declaration of peace, that the demand for silver from countries that have lost their gold in order to rehabilitate their currency will cause a sufficient volume of purchases to sustain current prices for some time to come."

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

COPPER.

New York, February 5, 1917.

The copper trade in January was aroused, a few days prior to the middle of the month, by reports of more large tonnages likely to be needed by the Entente Allied Governments, due to the decision that the war must proceed. During the dull days immediately preceding the needs of Germany, in the event of a cessation of hostilities, had been brought forward to encourage the trade. As a matter of fact, small business was transacted owing to various obstacles arising from time to time, among which were freight congestion, intermittent railroad embargoes, strikes at refineries and a reduced output for the month, estimated at 25,000,000 pounds less than the December production. These difficulties served, however, to develop a stronger tone in the open market and also caused an advance in the prices asked. An interesting feature was the quiet sale of 1,000,000 to 2,000,000 pounds of brass discs, made to J. P. Morgan & Company, for export. The New England manufacturers taking this business, however, were not conspicuously in the market for copper.

It is generally understood now that the heavy tonnage expected to be required by the Entente Allies for the second half of the year is held in abeyance.

Early in the fourth week in January London reported the rigid enforcement of new Government regulations restricting the use of copper to Government needs and prohibiting its use in ordinary manufactures. Immediately following this London cables announced an advance of spot electrolytic to £145; spot standard to £134; future standard to £130. Under present conditions London prices have little effect upon American quotations, and with the strong tone developed resisted efforts to depress prices. Spot electrolytic as we go to press is quotable at 32 to 33 cents for prompt shipment.

TIN.

The month of January in the tin trade was marked by unusual happenings. Foreign cables upon which the trade here is largely dependent were intermittent and then entirely withheld for several successive days, causing nervousness and developing pessimism in regard to future business; being resumed only after earnest protest had been made by strong interests in this country. Sellers at several different times, because of the uncertainties existing, refused to give quotations at all, preferring to hold supplies on hand as safety stocks. Foreign limits were subject to varying advances and recessions during the month, with a net advance of 2 cents a per pound for July-August arrivals. Spot tin at New York, after a slight recession early in the month, advanced steadily owing to conditions enumerated, to 45.50 cents per pound, receded later to 45⅛ cents, but under sensational political developments advanced to 51½ cents.

LEAD.

Lead was quiet and unchanged during the first days of the month with small demand and light offerings. Subsequently the Trust price of 7½ cents, New York, and 7.42½ cents, St. Louis, was shaded slightly, but about the middle of the month, under an improved demand, a stronger tone developed. Toward the close of the month sales of carload lots of spot were made at 8 cents, New York, and also at East St. Louis, but the Trust still adhered to the official base settling price of 7½ cents per pound at New York.

SPELTER.

The production of spelter in 1916 outstripped demand and stocks increased 3,000 tons during the year. January opened with prompt shipment spelter selling at 9.80 to 10 cents per pound, New York, and at 9⅝ to 9⅞ cents, East St. Louis. January-February-March positions showed a proportionate fractional decline. At the close of the month spot ranged from 10.55 to 10.80 cents at New York and from 10⅜ to 10⅝ cents, East St. Louis, an advance of ¾ to 1 cent per pound during the month. For the first four days of February prices receded to 9.80 New York or 9⅝ St. Louis, and higher prices are now looked for.

ANTIMONY.

Antimony was active, strong and bouyant during the last few days of the month, prices having advanced 5¾ to 6½ cents per pound on spot and 2 to 2½ cents per pound on shipments from the Orient, and is now held at 25 cents.

ALUMINUM.

At the beginning of January aluminum was quoted at 60 to 64 cents for No. 1 Virgin, 55 to 58 cents for 98-99% remelt and 40 to 45 cents for No. 12 alloy remelt. A weakening developed in prices as the month progressed and at the close the market declined to 57 to 59 cents for No. 1 Virgin 51 to 53 cents for 98.99% remelt and 37 to 39 cents for No. 12 alloy remelt.

QUICKSILVER.

During the month of January quicksilver sold uniformly at $80 per flask up to the 29th, when the price was advanced to $84. On the same day the London price was advanced 15 shillings to £19 10 shillings.

SILVER.

London quotations at the beginning of January were 36½d.; New York, 75 cents, and at the close of the month London showed an advance to 37 7-16d. and New York an advance to 77 cents. Today the official price is 37 5-16 d. at London, and .76¾ New York.

PLATINUM.

Platinum in January was subject to wide fluctuations, advancing from $90 per ounce at the close of December to $105 per ounce early in January, but a subsequent reaction carried the price down to $90 per ounce toward the end of the month, and this is the price today for pure.

ROLLED AND DRAWN METALS—SHEETS.

Copper sheets have been subject to small change during the month, prices being sustained when ingot copper fell and remaining steady when unwrought copper recovered, later in the month. Manufacturers continue to quote hot rolled sheets at 42 cents and cold rolled at 43 cents per pound. Copper wire, however, was more sensitive, responding to the rise in ingots, with an advance of ½ to 1 cent per pound. Many of the large wire drawers have capacity sold for the next three or four months. Trolley wire, however, available in the next four or five weeks can be bought at 34 to 35 cents, while smaller sizes range up to 37¾ and 39¾ cents per pound for February shipment and down to 37 cents base for May-June shipment. Brass sheets, wire and rods have remained steady.

OLD METALS.

There was a pronounced revival in the old metal trade toward the close of January, with a stronger tone and higher prices prevailing, in marked contrast to the weak, vacillating and irregular market experienced early in the month, when peace rumors had an unsettling effect.—W. T. P.

WATERBURY AVERAGE

The average prices of Lake Copper and Brass Mill Spelter per pound as determined monthly at Waterbury, Conn.:

Lake Copper, 1916—Average for year, 28.77. 1917—January, 32.25.

Brass Mill Spelter, 1916—Average for year, 17.725. 1917—January, 13.05.

JANUARY MOVEMENTS IN METALS

Copper.	Highest.	Lowest.	Average.
Lake	32.25	28.00	29.829
Electrolytic	33.50	27.75	30.256
Casting	29.75	26.50	28.045
Tin	45.85	42.50	44.19
Lead	8.00	7.50	7.558
Spelter	11.05	9.175	9.973
Antimony	25.00	14.25	16.457
Silver (cts. per oz.)	77.00	74.25	75.61

Metal Prices, February 5, 1917

NEW METALS.	Price per lb.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Lake, carload lots, nominal	32.00
Electrolytic, carload lots	33.00
Casting, carload lots	29.50
TIN—Duty Free.	
Straits of Malacca, carload lots	51.50
LEAD—Duty Pig, Bars and Old 25%; pipe and sheets. 20%. Pig lead, carload lots	8.50
SPELTER—Duty 15%.	
Brass Special	10.80
Prime Western, carload lots, nominal	9.80
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½ per lb.	
small lots, f. o. b factory	67.00
100-lb. f. o. b. factory	63.00
Ton lots, f. o. b. factory	59.00
ANTIMONY—Duty 10%.	
Cookson's Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	25.00
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad valorem.	
Shot Placquettes, Ingots, Blocks	45.00 to 50.00
ELECTROLYTIC—5 cents per pound extra.	
MANGANESE METAL	Nominal
MAGNESIUM METAL—Duty 25% ad valorem (100 lb. lots)	$3.50
BISMUTH—Duty free	$3.00
CADMIUM—Duty free nominal	$1.50
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	$1.50
QUICKSILVER—Duty, 10% per flask of 75 pounds	$90.00
PLATINUM—Duty free, per ounce	$90.00
SILVER—Government assay—Duty free, per ounce	76¾c.
GOLD—Duty free, per ounce	$20.67

INGOT METALS.			Price per lb.
Silicon Copper, 10%	according to	quantity	46 to 49
Silicon Copper, 20%	"	"	47 to 50
Silicon Copper, 30% guaranteed	"	"	49 to 52
Phosphor Copper, guaranteed 15%	"	"	46 to 50
Phosphor Copper, guaranteed 10%	"	"	45 to 49
Manganese Copper, 30%, 2% Iron	"	"	46 to 50
Phosphor Tin, guaranteed 5%	"	"	65 to 68
Phosphor, Tin, no guarantee	"	"	53 to 55
Brass Ingot, Yellow	"	"	21½ to 24
Brass Ingot, Red	"	"	27 to 29
Bronze Ingot	"	"	27 to 29
Parsons Manganese Bronze Ingots	"	"	33½ to 35
Manganese Bronze Castings	"	"	32 to 42
Manganese Bronze Ingots	"	"	25 to 30
Phosphor Bronze	"	"	34 to 36
Casting Aluminum Alloys	"	"	42⅞ to 45

Dealers' Buying Prices.	OLD METALS.	Dealers' Selling Prices.
28.00 to 29.00	Heavy Cut Copper	30.50 to 31.00
26.00 to 26.50	Copper Wire	28.00 to 28.50
22.00 to 23.00	Light Copper	24.00 to 25.00
21.00 to 22.00	Heavy Mach. Comp	23.00 to 24.50
15.25 to 16.00	Heavy Brass	17.00 to 18.00
12.00 to 13.00	Light Brass	13.50 to 14.30
15.75 to 16.25	No. 1 Yellow Brass Turning	16.50 to 17.25
16.25 to 17.00	No. 1 Comp. Turnings	17.00 to 18.00
7.00 to 7.25	Heavy Lead	7.62 to 7.75
7.50 to 8.00	Zinc Scrap	8.50 to 9.00
20.00 to 22.00	Scrap Aluminum Turnings	21.50 to 22.00
28.00 to 29.00	Scrap Aluminum, cast alloyed	34.00 to 36.00
48.00 to 49.00	Scrap Aluminum, sheet (new)	51.00 to 54.50
30.00 to 31.00	No. 1 Pewter	32.00 to 33.00
28.00 to 30.00	Old Nickel	32.00 to 34.00
21.00 to 23.00	Old Nickel anodes	25.00 to 26.00

PRICES OF SHEET COPPER.

Mill shipments (hot rolled) .... 42c. base net
From stock .... 44c. base net

SIZE OF SHEETS.		64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
Width.	LENGTH.	Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins., but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins., but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins., but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins., but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins., but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches	2	4	7						
	Not longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from .... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from .... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices .... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices .... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper .... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper .... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper .... 1c.

Metal Prices, February 5, 1917

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect November 18, 1916.

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.43	$0.44½	$0.47
Wire	.43	.44½	.47
Rod	.43	.45½	.48
Brazed tubing	.48	——	.52
Open seam tubing	.48	——	.52
Angles and channels	.48	——	.52

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.45	$0.46½	$0.49
Wire	.45	.46½	.49
Rod	.45	.47½	.50
Brazed tubing	.50	——	.54
Open seam tubing	.50	——	.54
Angles and channels	.50	——	.54

[Note.—Net extras for quality for both sections of above metal prices are not quoted due to the fluctuations in the price of zinc.—Ed.]

BARE COPPER WIRE—CARLOAD LOTS.

36c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	41c.	per lb. base
100 lbs. to 300 lbs. in one order	41½c.	" " "
Less than 100 lbs. in one order	43c.	" " "

PRICES FOR SEAMLESS BRASS AND COPPER TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, — per lb.
Seamless Copper Tubing, — per lb.

For other sizes see Manufacturers' List.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛ ¼ ⅜ ½ ¾ 1 1¼ 1½ 2 2½ 3 3½ 4 4½ 5

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Rod	42c.	net base
Muntz or Yellow Metal Sheathing (14" x 48")	38c.	" "
Muntz or Yellow Metal Rectangular sheets other than sheathing	43c.	" "
Muntz or Yellow Metal Rod	39½c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 65c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

PRICES OF NICKEL ANODES.

85 to 87% purity	47½c.	per lb.
90 to 92% "	50c.	" "
95 to 97% "	52½c.	" "

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Base price, 60c.

We are unable to quote these prices, but they can be had upon application to manufacturers and dealers.

PRICE LIST SEAMLESS ALUMINUM TUBING.

We are unable to quote these prices, but they can be had on application to manufacturers and dealers.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

We are unable to quote these prices.

PRICES OF SHEET ZINC.

Duty, sheet, 15%.	Cents per lb.
Carload lots, standard sizes and gauges, at mill	21 cent basis, less 8%
Casks, jobbers' prices	22.00
Open casks, jobbers' prices	22½

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	48½c.	16%	53c.
8%	49½c.	18%	53½c.
10%	49¾c.	20%	55¼c.
12%	51½c.	25%	63c.
15%	52c.	30%	68½c.

GERMAN SILVER WIRE.

Quality.	Net per lb.	Quality.	Net per lb.
5%	50c.	15%	58c.
8%	52c.	16%	58½c.
10%	54c.	18%	60½c.
12%	56c.	30%	76c.

The above Base Prices are subject to additions for extras as per lists printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more 5c. over Pig Tin. 50 to 100 lbs. 6c. over, 25 to 50 lbs. 8c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 7c. over Pig Tin. 50 to 100 lbs. 8c. over, 25 to 50 lbs. 9c. over, less than 25 lbs. 15c. over.

Above prices f. o. b. mill.

Prices on wider or thinner, metal on request.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2½c. to 3½c. above the price of bullion.

PRICES OF SOME METAL INDUSTRY CHEMICALS.

Phosphorus—Duty free, according to quantity	40c. to 50c. per lb.
Nickel Salts, Single bbl	14c. " "
Nickel Salts, Double bbl	11c. " "
Sodium Cyanide	Nominal
Silver Nitrate	53⅜c. per oz.
Sodium Carbonate (Sal Soda)	.05c. per lb.